HINDUJA FOUNDATION ENCYCLOPAEDIA OF NOBEL LAUREATES

1901-1987

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Dr ASOKE K BAGCHI

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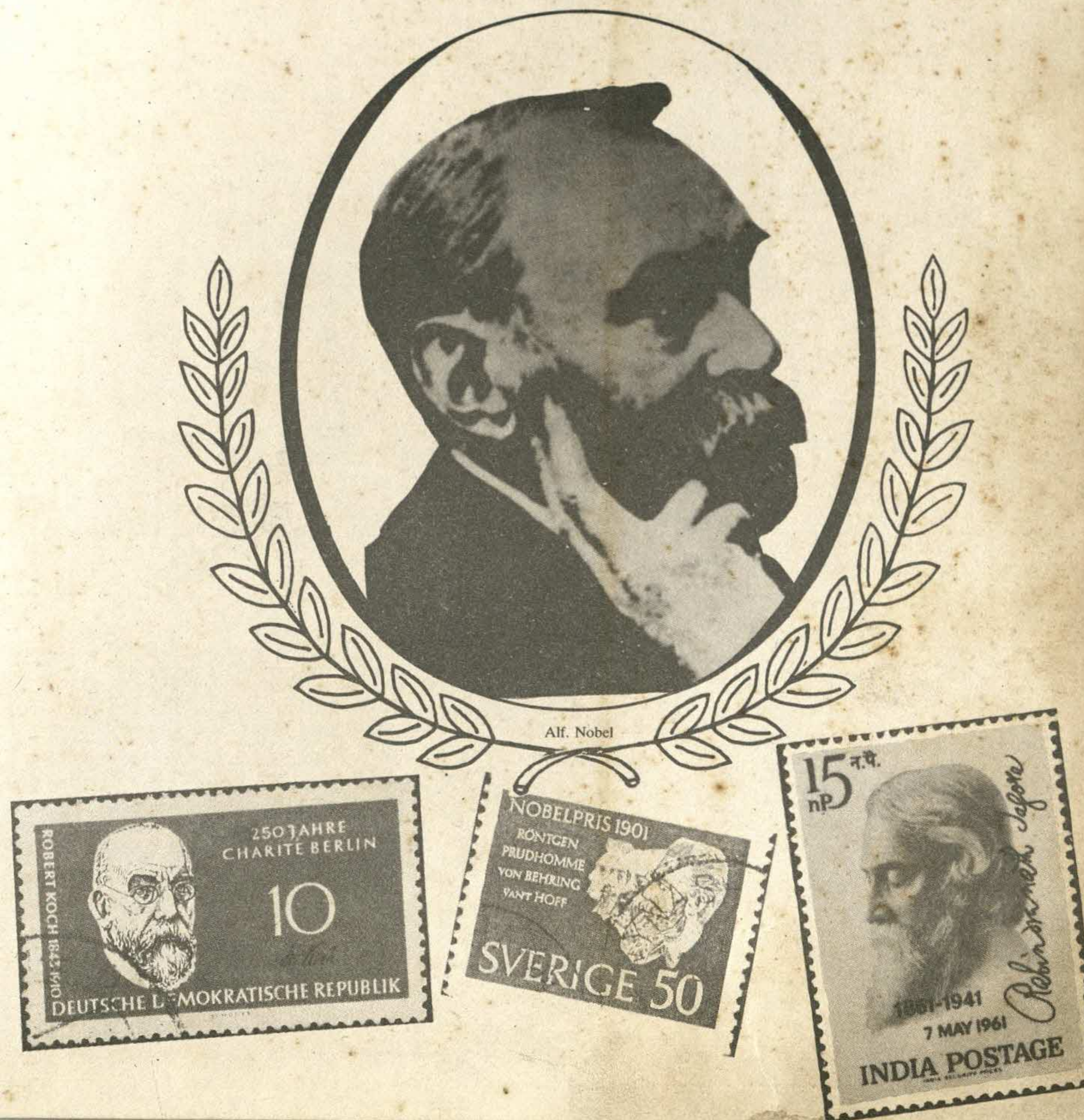

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1901-1987

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Dedicated to
Mohandas Karamchand Gandhi
"The Mahatma"
The Most Deserving But Denied

MISSIONARIES OF CHARITY

"As long as you did it to one of these My least brethren. You did it to Me"

24-4-87

May God's blessing
be with the efforts
of Dr. A. K. Bagchi
in writing - the
Encyclopaedia of
the Nobel Laureats

God bless you
M Teresa MC

Foreword

"Lives of great men all remind us
We can make our lives sublime,
And, departing, leave behind us
Footprints on the sands of time."
—*Henry Wadsworth Longfellow* (1807-82)

The mind of man is the measure of things. . . there is no truth to be had beyond the impressions made on man's mind.

This Encylopaedia of Excellence covers the lives of those who have contributed most to human progress, over the last century and received international recognition as Nobel Laureates. They were the pioneers, who dared to explore the frontiers of human knowledge and to expand them for the benefit of all mankind.

It is a fact that the strides taken, particularly, in science and technology, during our present century have been truly spectacular with the progress made each year, covering, as it were, more ground than had been possible during the previous hundred years.

George Bernard Shaw once declared: "Reason enslaves all whose minds are not strong enough to master her." So it is, that the errors of a wise man are said to be preferable to the perfections of a fool!

Like any worthwhile institution, the Hinduja Foundation in India, which was set up in 1969, has today grown both in size and scope. Its activities have left few areas untouched. It has built the P.D. Hinduja National Hospital in Bombay, with advanced facilities, that can be compared to the best in the world. Besides another hospital in Bangalore, with its own cardiac centre, the Foundation supports a number of educational institutions, like the KPB Hinduja College of Commerce in Bombay and the P.D. Hinduja Sindhi Model Senior Secondary School in Madras, as well as a Polytechnic in Aurangabad. In addition, the Foundation awards scholarships for studies abroad, as also within India, to deserving students.

Recently, a Harvard-Hinduja Endowment of $2 million has been set up to promote interaction between Institutions of advanced learning in India and Harvard University in the USA. The latest project of the Foundation is the programme "Drinking Water for the Millions" to provide this essential amenity in rural areas where such facilities do not exist. It is, therefore, with pride that the Hinduja Foundation associates itself with the publication of this Encylopaedia as a fitting tribute to those great men and women whose achievements have been outlined within its covers.

Through this *Encylopaedia of Nobel Laureates, 1901-1987* the Hinduja Foundation wishes to reach out to the hearts and minds of all those who aspire to achieve excellence and have the courage to break out of the constraints which surround them.

President
Hinduja Foundation
New Delhi

A.P. VENKATESWARAN

Preface

There are many detailed biographies of the Nobel Prize Winners in various languages. Those are sold at very high prices by respective publishers. In many of the current encyclopaedias like the *Encyclopaedia Britannica* and the *Current Biographies* some excellent descriptions can be found. But, imagine how many of us have access to those Encyclopaedias? In some national publications biographies of the laureates can be found, but there lies the language barrier, so, interested readers cannot utilise them. Some of the biographies are without the photographs of the laureates.

It is an extremely arduous task to procure the photographs of the laureates from the various archives and collections. Some of the archivists are so parochial that they refuse to give photographs to intending authors and collectors. Some of the laureates are defied so that, their photographers have imposed copyrights on their photos, and sell those at high premium. Some Nobel laureates themselves are mercenary and sell their own photographs! One of the Physics laureates of a Scandinavian country did not reply to my chain of request letters. His secretary curtly replied that the laureate never gives away his photo. But to my utter surprise I located his photograph on a calendar published by a pharmaceutical manufacturer of Sweden. His strange behaviour is quite amusing. Some institutions where the laureates worked do not care to preserve their spare photographs, as it specifically happened in case of Dr. Theodore William Richards, the first American born Nobel laureate (1914) who worked in the Department of Chemistry at the Harvard University. It was indeed a great pleasure for me to have supplied an enlargement of his photo to his own department at Harvard from my collection.

I approached the Nobel Foundation for some of the photos which they initially declined to supply, but at the request of one of my learned Norwegian friends presently living in Sweden they gave me a set of excellent prints of some Scandinavian Laureates as an exceptional free gift. I am indeed grateful to the Foundation and to my friend. It is an accepted norm that knowledge is for propagation, why then are some of the archivists so possessive of the pictures of the laureates?

In the book one could find the lives and the likes of the laureates from 1901 to 1987 under all the classifications. In my book I have tried my best to collect the likes of the laureates contemporary to their investitures. One may see the young laureate Einstein whom very few have seen.

There are many more interesting features like the Banting-Macleod scandal and other such anecdotes. There are the lists of ethnic, familial and national break-ups.

A favourable reception of the book by the present generation, specially the young ones, will bring me happiness and gratification as many future laureates are lying dormant among them. It would be appropriate to quote from the noted Bengalee poet Golam Mustafa who wrote:

Ghumiye āche sisur pitā sab
Sisuri antare....
(Inside every child's mind a father lies dormant)

ASOKE K. BAGCHI

Publishers' Note

Though the majority of Nobel Laureates are non-Indians, it is India that is taking the initiative for the first time to publish an Encyclopaedia of Nobel Laureates.

As universally recognised, the Nobel Prize is the highest form of recognition that an individual can achieve. Who was Alfred Nobel, what led him to conceive such a scheme, how it has been administered over the decades and how, despite a few lapses here and there, the Nobel Prize has got established as the ultimate in human achievement are details that are known. Articles and books have been written by several persons setting out these details.

But what is not widely known is who these outstanding individuals were, what was the nature of their achievements, what did they accomplish after the prize was given to them, and so on. All these questions and several more are answered in this *Encyclopaedia*. In addition, it contains the basic information about their childhood, upbringing, academic career and such other details.

By now, more than 600 persons have been given the Nobel Prize. They belonged to different countries and different continents and only some of them are still alive. Collecting information about them was not an easy job. More difficult than that was securing their photographs. Owing to the dedication and persistence of the author who got interested in this project and has pursued it for over a quarter century, all this information is now available in this reference work. The author was inspired to undertake this project by his Professor, Dr Hans Hoff, who had studied under a Nobel Laureate, Dr Wagner von Jauregg.

The *Encyclopaedia* has been designed as much for personal possession as a guide to home reading as for consultation in schools and colleges, public and institutional libraries, and by journalists and other professional writers.

Arranged chronologically, the contents comprise entries on all the Nobel Laureates. Each entry contains a short biographical sketch followed by a brief account of the major achievements. The prize-winning works have been highlighted.

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The Johns Hopkins University School of Medicine, USA.

Dr Maclenon, Director, Banting & Best Institute, Toronto, Canada.

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The Mayor of Algiers (*El Djezair*), Algeria, North Africa.

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Last of all I must thank my departed friend, the late Senor Manuel Garcia Martinez, formerly of Managua, Nicaragua and my former student Dr J.S. Srivastava who were very kind to procure some of the photographs.

Due to oversight I may have left out many other personalities and sources for which I may kindly be forgiven.

ASOKE K. BAGCHI

Alfred Nobel and His Nobel Prizes

Alfred Bernhard Nobel was born on October 21, 1833 at Stockholm and died on December 10, 1896 at San Remo, Italy. He was a chemical engineer and industrialist who invented dynamite, a powerful explosive and founded the Nobel prizes. His mother was related to the Swedish naturalist Olog Rudbeck who was noted for his discovery of the lymphatic vessels (c. 1653). His father Immanuel Nobel taught him the fundamentals of engineering and sharpened his inventive mind.

The Nobels were descendants of Scanian farmers from the southern tip of Sweden and the name, Nobelius, was assumed, in the usual seventeenth century mode, by the first member of the family who was able to get a university education. The reason why he chose Nobelius, was that he was born in the parish of Nobbelov.

The family of Nobels descended from the marriage of Petrus Olavi Nobelius and Vendela Rudbeck. One of the grandsons of Nobelius and Rudbeck, who served in the army, shortened the family name to Nobel. The Rudbeckian trait which was an interest in art and inclination for invention was manifest in the descendants. The Rudbeckian trait was more marked in Alfred Nobel. Alfred had three brothers. He obtained in Sweden a patent on his invention of a percussion detonator called the "Nobel lighter". Nobel set up a small plant at Heleneborg near Stockholm.

The Nobel family left Stockholm in 1842 and went to St. Petersburg. Alfred was educated mainly by private tutors and was a competent chemist at the tender age of only 16 and was fluent in English, French, German, Russian and Swedish. He left Russia in 1850 to spend a year for studying chemistry in Paris and four years in the USA. After his return to St. Petersburg, he worked in his father's factory until it went bankrupt in 1859. He returned to Sweden and began the manufacture of the liquid explosive nitroglycerin. Shortly after the production was under way in 1864, the factory blew up, causing the death of his youngest brother, Emil, and four workers. He was forbidden by the Swedish government to rebuild the factory, and was mocked as a "mad scientist". He began experimenting on a lake-barge to find a way to minimize the danger of handling nitroglycerin. A chance discovery that nitroglycerin was absorbed to dryness by an organic packing material like cellulose and could thus be handled safely led him to perfect dynamite and the necessary detonating cap. He was granted patents for dynamite in Britain (1867) and the USA (1868) and further experimented and developed a more powerful form of dynamite called blasting gelatin which was patented in 1876. About a decade later, he produced *ballistite*, one of the first smokeless powders derived from nitroglycerin.

His worldwide interests in explosives plus large holdings in the Baku oilfields of Russia brought him immense wealth but it required him to travel almost constantly. He had the inclinations of a recluse. However, he was essentially a pacifist and feared that the destructive powers of his inventions might bring doom to the world. A pessimist, he had a keen interest in literature, and in his youth he had written poems in English. The scriblings of a novel were found among his waste papers.

By nature Alfred was a melancholic, a dreamer. He was never a social success. He was a confirmed atheist because to him God seemed a cruel, unjust world ruler, who was to blame for all the religious wars and persecutions.

None of the Nobel's biographers has shed any light on his bachelorhood. The name of only one lady appears in his biography; she is Bertha von Suttner who had been Nobel's secretary and their relationship had never been anything more or anything less. Bertha was then a radiant beauty.

With all his fame, name and money Nobel was extremely unhappy which is proved from the following satirical description of himself:

"Alfred Nobel, a miserable half-life, ought to have been choked to death by a philanthropic physician as soon as, with a howl, he entered life."

Nobel ended his days surrounded only by his retinue of French servants and without having, as he had dreaded, near him any "close friend or relation whose kind hand would some day close one's eyes and whisper in one's ear a gentle and sincere word of comfort."

He was a generous philanthropist; he left the bulk of his fortune in a trust to establish what came to be the most highly regarded of international awards, the Nobel Prizes. In November 1895, the Nobel foundation or the "*Nobelstiftlesen*" announced the award of five annual prizes for original work in the field of Physics, Chemistry, Physiology or Medicine, Literature, and maintenance of peace among people. The Nobel Memorial Prize for Economic Sciences was established by the National Bank of Sweden in 1969.

Alfred Nobel's attitude to the peace questions was influenced by his interest in literature. He was acquainted with the Austrian authoress Bertha von Suttner who had a profound influence on him. They met for the first time in Paris in 1876 when she replied to his advertisement for a private secretary. In 1887, when the Suttners were living in Paris, he met her again. Nobel admired Bertha von Suttner's writings and her propaganda work for international peace. Nobel kept her viewpoint in mind and, in 1892, appointed an unemployed Turkish diplomat named Aristarchi Bay to advise him on the peace problem. Gradually, Nobel became confident of the idea of instituting a prize for peace. But there is no reliable evidence to explain why he gave the Norwegian *stortinget* (parliament) the responsibility to form a Peace Prize Committee instead of any one from his own country, Sweden. Some people thought that the decision of Nobel was to bring about a relaxation of tension between Sweden and Norway. But the Swedish newspapers became highly critical and indignant as it was entrusted to the 'Separatist Norwegians'.

Each of the above prizes can be divided between not more than three contestants and must be awarded at least once in every five years. Each prize consists of a large sum of money (in 1985 the value was 1,800,000 Swedish Kronor), a gold medallion and a diploma. It is incumbent on each recipient to give a public lecture on a subject connected with the work within six months of the bestowal of the prize. The prizes are officially presented on the 10th December every year, the annual death anniversary of Alfred Nobel.

To quote from *Nobel—The Man and His Prizes* (Elsevier Pub. Co., Amsterdam, London, New York), *"How are we now to assess the awards which have been made in course of the last sixty years? It is of course, as already intimated, a tremendously complicated question to answer. But let us begin with the objection which has so far been made, that 'real' pacifists have not been rewarded. If we run through the list of all those who have been proposed, we shall however, practically speaking, only find one name where this objection is really justifiable, namely Mahatma Gandhi."*

One may assume that the role played by the Mahatma in the struggle for freedom in India and the close family relationships between the British and Norwegian Royal Houses had a part to play in this act of partiality and genuine denial of the prize to the great Indian apostolic pacifist. People who followed his principles of non-violence like the Late Dr. Martin Luther King and Senor Adolfo Perez Esquivel were awarded

Nobel Prizes for peace in later times. There is the first precedence of awarding the Nobel Prize for literature to Axel Karlfeld of Sweden posthumously, it was contrary to the rigid rules. The rule was again violated while giving a posthumous award of the Peace Prize to Dag Hammarskjoeld in 1961, also a Swede. Why could it not be done also in the case of the Mahatma? When the Mahatma was assassinated in 1948, the British regal and political influences on India were no longer extant, as India had gained freedom in 1947. A posthumous Peace award could have at least proved the genuineness and impartiality and the credence to their later pricking of conscience as expressed in the *Nobel—The Man and His Prizes*! Will there be a revival of the case of the Mahatma after the worldwide release of his biographical motion picture by Sir Richard Attenborough? The world has again expressed its appreciation of the Mahatma in no ambiguous terms by awarding eight Oscars to the motion picture. *Why cannot the Norwegian stortinget now react by the investiture of a posthumous peace award to the Gandhi Memorial Foundation*? The first lapse can now be rectified in a decent and humane way.

In the first sixty years of the Nobel awards, ethnic Scandinavians got 31 of the prizes in various categories of which thirty were divided between the Swedes and the Norwegians. One may question pertinently today whether all of those Scandinavian recipients were up to the high Nobel standards? The other prominent neighbour of the Swedes, the Germans, bagged forty-nine prizes in sixty years, but the poor Russians got only seven during the same period. The Russian physiologist Ivan Petrovich Pavlov was nominated for the first Nobel Prize for medicine in 1901. To verify the truth of his claims on the success of inducing conditioned reflexes in dogs with artificial gastric fistulae, a team of two Swedish professors was sent to St. Petersburg from Stockholm to meet Pavlov personally and to verify the experimental authenticity of his claim. The professors were not satisfied, so, Pavlov had to wait till 1904 for his prize! At that time the Nobel committee also favoured Niels Finsen, a Danish Physician, and Ronald Ross, an Indian-born British scientist researching on the transmission of the parasites of malaria, but every one still wonders how Emil von Behring, the German immunologist, won the rat-race for the first ever Nobel Prize in medicine! Sir Charles Scott Sherrington's name was proposed and rejected for three decades before he was awarded a prize in Medicine in 1932. The father of modern chemotherapy Paul Ehrlich was nominated for the Nobel Prize seventy times in eight years by learned men from thirteen countries! At last, in 1908 he received the prize. Was the reason for this inordinate delay engendered out of his being an ethnic Jew? Sir Alexander Fleming discovered the 'penicillin' producing fungus *Penicellium notatum* in 1928, but strangely he had to wait till 1945 to share his glory with Howard Florey, the Australian, and Boris Chain the emigrant German Jew.

In 1923, Frederick Banting and John Macleod of the Toronto University were jointly credited with the discovery of insulin and were awarded the Nobel Prize for medicine. As far back as 1901 L.V. Sobolev, a Russian physiologist, was searching for an insulin like substance as he was aware of its presence in the human body. Banting, Macleod as well as C.H. Best and J.B. Collip pursued the search for a similar substance in the physiology laboratory headed by Professor Macleod, but strangely enough only the first two were credited for the discovery! Banting, a man of immense personality, immediately disapproved of the fact and resented the credit given unduly to Macleod. He pointed out that, on the final day when insulin was discovered Macleod was not even present in the laboratory! To express his disapproval Banting gave half of his share of the prize to his student-assistant C.H. Best. Macleod was put in an embarrassing position, so he retaliated by giving half of his share of the prize to Professor J.B. Collip. So, the grandeur of the entire award for 1923 culminated into a farce!

One of the most deprived medical scientists was Sigmund Freud. He is a name which has an honoured place in the history of psychological medicine. The Nobel judges had persistently rejected his candidature as he had peeled off the surface of the so-called civilized mind and dug into the obscurant interior of the subconscious mind where the beast inside a man lodges with the lust of sexual desire. He was the father of psychoanalysis and revealed the complex mysteries of human motivation.

Antisemetism cropped up while considering the name of Albert Einstein for a prize in physics for his theory of relativity. Philipp Lenard, the German Nobel Laureate physicist of 1905, opposed Einstein by considering his theory of relativity as an insignificant discovery. So, Einstein had to wait till 1921, when he was rather doled out a prize in physics for his lesser law of photoelectric effects. Who could imagine at that time that the authenticity of the theory of relativity would be proved in the middle of our century during the exercises in space rockettery and journeys into extraterrestrial spaces!

In giving the awards for the prizes in literature strange things have happened again and again. Authors like Tolstoy, Zola, Ibsen, Proust, Mark Twain, Joseph Conrad, Maxim Gorki, Dreiser, Strindberg and many others alike have been denied any considerations, whereas almost unknown authors like Gabriella Mistral and Grazia Deledda have been made literature laureates. Strindberg, the great Swedish dramatist, is once reported to have said, "The anti-Nobel Prize is the only one I would accept."

If one analyses the whole process of selection for an award in any subject, such discrepancies will certainly be revealed. However, one cannot deny that the Nobel awards are considered to be the supreme appreciation of any individual and he who is fortunate to receive a prize is regarded with awe, honour and surprise. In one word, a Nobel Prize is covetable but its nobility is rather questionable!

It is very surprising to note from the list of Nobel Laureates that so far only five Japanese scientists have won the Nobel Prize. They are Hideki Yukawa (Physics, 1949); Sin-Itiro Tomonaga (Physics, 1965); Kenichi Fukui (Chemistry, 1981); Leo Esaki (Physics, 1973); and Susumu Tonegawa (Physiology/Medicine, 1987). In spite of the fact that Japan is a highly industrialised country and it has some of the most advanced physical, chemical, electronics and engineering research laboratories in the world it is puzzling to note that the country has produced only five. Nobel Laureates.

Criticisms to the Nobel award process are being openly made by a group of scholars though very small. They have analysed the Nobel selections and records in an effort to evaluate how well the various selection committees so far acted since the introduction of the prizes in 1901.

The critics of the Nobel Prize feel that the initial restrictions imposed by the last testament of Alfred Nobel, the donor, are the principal obstacles to the selection of some of the most eminent scientists of the world. Nobel never envisaged the phenomenal progress and diversification of the various branches of sciences. He never thought that geology, computer sciences, psychology will become important branches of science in the twentieth century.

There are some obscurant evidences of internal intrigues prevalent among members of the different selection committees arising out of personal favouritism, jealousies and rivalries. There are also some deprived people who kick-up a lots of dust as happened in the case of the Indian poet Tagore.

Prof. Donald Heming, a science historian at the Harvard University, alleged that the prizes clearly encourage a narrow and unbalanced concept of science. He also said that it is a real question whether the prizes were helpful or harmful.

Harriet Zuckermann, professor of sociology at the Columbia University, said that the prizes have been overblown as a supreme symbol of scientific excellence.

One of the most disastrous awards was made to the Danish scientist Johannes Fibiger under the category of Physiology/Medicine in 1926. He claimed to have been able to produce cancer artificially in the laboratory. But his claim later turned out to be totally false!

Johann von Neumann and Norbert Wiener, two of the greatest mathematicians of ourcentury, were never considered for the prize. Neumann is the father of the theory of computers which has virtually changed the entire perspective of scientific progress in the modern world. Allan Cormack and Godfrey Hounsfield who only applied borrowed computer technology to the already extant radiological method of tomography were bestowed with Nobel prizes. They just applied the concept of Neumann who was deprived of his legitimate glory.

Nils Gustaf Dalen, a Swede physicist who developed a trivial device called "Solventil", was awarded a prize in 1912. Was it because he was a Swede and had a few committee members to influence his selection over others?

It was rather unusual when a Peace prize was awarded to the US agricultural scientist, Norman Borlaug, who initiated the Green revolution in the world. The award of the Peace Prize to the dissident Soviet nuclear physicist Sakharov was simply politically motivated to irk the Russian hierarchy. The Russians have often been neglected by the selectors of the Nobel committee.

Arne Tiselius, Nobel Laureate and a former Vice-President of the Nobel Foundation, aptly remarked: "The world is full of brilliant scientists, who never have received the Nobel Prize and never will." A striking example was our own Professor Satyen Bose who corrected even Albert Einstein! The award of the Nobel Prize in literature to Tagore as early in 1913 irked many a Western scholar and intellectual. W.B. Yeats, who wrote an effusive preface to the first edition of Tagore's *Song Offerings* (Geetanjali), did not even congratulate Tagore when the award was made! Tagore won the prize at the age of 52 when only a few of his works were available in English translations. But the *Song Offerings* (1912 and 1913) took the literary world by surprise.

As soon as Tagore received the telegram of the announcement, he made no fanfare and quietly handed it over to his close associate Sri Nepal Roy and said, "Here is your fund for the sanitation and drainage of Shantiniketan." The sum was deposited in a local cooperative bank which closed its shutters only a few years later and the fund evaporated in the thin air.

Before concluding, we would like to mention that Jean Paul Sartre did not accept the prize as he said that his personal philosophy did not compromise with that of the Nobel award. Similarly, the Vietnamese Peace Laureate Le Duc Tho declined the prize as he could not equate himself with the other recipient, Henry Kissinger, who was indirectly instrumental in the killings of millions of Vietnamese people.

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1901

PHYSICS

Röntgen, Wilhelm Conrad

CHEMISTRY

Van't Hoff, Jacobus Henricus

PHYSIOLOGY OR MEDICINE

Von Behring, Emil Adolf

LITERATURE

Sully, Prudhomme

PEACE

Dunant, Jean Henri / Passy, Frédéric

1901

Physics

In recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him.

Röntgen, Wilhelm Conrad, b.—March 27, 1845, Lennep, Prussia, now in Remscheid, West Germany, d.—February 10, 1923, Munich. Right from the early days Röntgen's ambition was to study science. He believed in the importance of the application of science in everyday life. He was of the opinion that scientific inventions and discoveries should benefit every man. Even under difficult circumstances he held on to his ideals.

Röntgen, having been expelled from school, could not have a formal education and hence could not attend university. He studied engineering at the Polytechnich of Zürich. When he became an assistant to the famous German Physicist August Kundt, he decided that his future lay in pure and not applied science. He eventually joined the University of Würzburg in Bavaria and in 1895 while he was the head of the department of physics made the historic discovery.

His research also included work on elasticity, capillary action of fluids, specific heats of gases, conduction of heat in crystals, absorption of heat by gases, and Piezo-electricity.

While experimenting with electric current flow in a cathode-ray tube, Röntgen observed that a nearby piece of barium platinocyanide gave off light when the tube was in operation. He theorized that when the cathode rays struck the glass wall of the tube, some unknown radiation was formed that travelled across the room, struck the chemical, and caused the fluorescence. Further investigation revealed that paper, wood, and aluminium, among other materials, are transparent to this new form of radiation. He found that it exposed photographic plates, and, as it did not noticeably exhibit any properties of light, such as reflection or refraction, he mistakenly thought the rays were unrelated to light. In view of its undetermined nature, he called the phenomenon X-radiation, in course of time it also became known as Röntgen radiation to immortalize his name.

RÖNTGEN, WILHELM CONRAD
Germany

Within days of his successful demonstration, X-rays were being used in the US to locate a bullet in a man's leg. X-rays play a vital role in medical diagnosis today. Röntgen's work helped investigating scientists to reveal the secrets of the atom and its nucleus. Thus, his work led directly to the discovery of radioactivity. His discovery revolutionized medical therapy and diagnosis. It is widely used in many fields of science and industry as an analytical tool.

Röntgen refused to patent any aspect of X-ray production as he was contented to see his discovery having found its use in the service of mankind. Ironically enough and contradictory to his liberal attitude towards mankind, during the hyperinflation which destroyed the German economy in the 1920s, Röntgen died in utter poverty.

Chemistry

In recognition of the extraordinary services he has rendered by the discovery of the laws of chemical dynamics and osmotic pressure in solutions.

Van't Hoff, Jacobus Henricus, b.—August 30, 1852, Rotterdam, d.—March 1, 1911, Berlin. A Dutch physical chemist, he won the prize for his studies on the rates of reaction, chemical equilibrium and osmotic pressure.

VAN'T HOFF, JACOBUS HENRICUS
The Netherlands

After initial studies in the Netherlands he worked under August Kekulé at Bonn and then at the Paris Laboratory of Charles Adolphe Wurtz where he met Le Bel. In 1874 he and Le Bel announced the concept of the tridimensional character of organic compounds independently of each other. Hoff served as professor of chemistry, mineralogy and geology at the Amsterdam University (1878-96). In 1884, he published *Etudes de dynamiqué chimiqué* (Studies in Chemical Dynamics). He introduced the modern concept of chemical affinity. In 1896 he became professor at the Prussian Academy of Sciences, Berlin.

His significant study on the salt deposits at Stassfurt in Germany led to the development of German chemical industry. In 1887, he and Wilhelm Ostwald founded the famous *Zeitschrift fuer physikalische Chemie* (Journal of Physical Chemistry).

Physiology or Medicine

For his work on serum therapy, especially its application against diphtheria, by which he has opened a new road in the domain of medical science and thereby placed in the hands of the physician a victorious weapon against illness and deaths.

Von Behring, Emil Adolf, b.—March 15, 1854, Mansdorf, Prussia, now in East Germany, d.—March 31, 1917, Marburg, West Germany. A bacteriologist who is considered to be the founder of the science of immunology, he received the prize for his work on serum therapy, especially its application against diphtheria.

The son of a school master, he was destined by his father to study theology. Through the intervention of a friend who was a military doctor, he was able to enter the army doctor's academy in Berlin. He was a methodical man and his lecture notes reveal his thoroughness. He was also noted for his incisive speech and caustic remarks. He rose at 4 o' clock every morning; his first meal was a juicy steak. When his colleagues arrived at the laboratory, he had already finished half the day's work.

Behring served with the German Army Medical Corps before becoming assistant at Koch's Institute of Hygiene in Berlin. There, with the Japanese bacteriologist Kitasato, he showed that it was possible to provide an animal with passive

VON BEHRING, EMIL ADOLF
Germany

immunity against tetanus by injecting it with the blood serum of another animal infected with the disease. Behring then applied the same technique of antitoxic immunity (a term which he and Kitasato originated) to prevent diphtheria.

He invented a vaccine for immunization of calves tuberculosis. His writings include *Die Praktischen Ziele der Blutserumtherapie* (1898) and *Aetiologie und aetiologische Therapie des Tetanus* (1904). He was an associate of Robert Koch and received the prize much ahead of him. Kitasato who was closely associated with his formulation of diphtheria antitoxin, was strangely left out of his share of the prize.

In 1894, Behring became a professor at the University of Halle, and in 1895 at the University of Marburg. In Marburg, he finally succeeded, a few years before his death, in establishing a method for the immunization of human beings against diphtheria and producing the vaccine T.A. Even during World War I, when waves of national enthusiasm were running high, Behring remained a non-chauvinist. A letter written to him by a Russian woman from Moscow summarizes his achievement: "I do not know if many mothers have expressed their gratitude to you. But my child is saved because you thought so wise and fought for science... Your name is blessed by happy mothers like me."

Literature

In special recognition of his poetic composition, which gives evidence of lofty idealism, artistic perfection and a rare combination of the qualities of both heart and intellect.

Sully, Prudhomme (real name **Prudhomme, Rene Francois Armand**), b.—March 16, 1839, Paris, d.—September 7, 1907, Chatenay. A poet and a leading member of the French Paranassian movement, which sought to restore elegance, balance and aesthetic standards to poetry in opposition to the excess of romanticism. He studied science at school and his first job was as a clerk in a factory. He left the job in 1860, to study law. In 1865, he started publishing a series of melancholic verses emanating from an unhappy love affair which were published as *Stances et Poemes* (Stanzas and Poems) followed by *Les Euries d'Augias* (The Augean Stables, 1866), a paraphrased translation of the ancient Greek poem. *Goquis italiens* (Italian notebook, 1866-68), *Solitudes*(1869) contain a poetic projection ot the inner conflicts experienced by the young Sully Prudhomme. Metaphysical doubts form the keynote of his poetry.

SULLY PRUDHOMME (pen-name of PRUDHOMME, RENE FRANCOIS ARMAND)
France

1870 was the most crucial year in his life. In January, within a space of a few days, his uncle, aunt, and mother died; the shock paralysed his lower body. The outbreak of the Franco-Prussian War came as a cruel blow for a poet steeped sensitively in pacifist illusions. This led to works like *Impressions de la guerre* (Impressions of War, 1870), *Les Destins* (The Destinies, 1872), *France* (1874), *Justice* (1878), *Le Bonheur* (Happiness, 1888), and *Les Epreuves* (Trials, sonnets published posthumously in 1908). Emotionally, he convinced himself that moral progress would go hand in hand with material progress. But he is still remembered for his connections with the Paranassians, who reacted against romanticism and attempted to express the positivist philosophy and scientific achievements of the time through poetry. His later works like *Que sais-je?* (What do I know?, 1896) and *La Vraie* (True Religion according to Pascal,1905) are rather obscurantic which deal with the problems of expressing philosophical themes in verse.

He was elected to the French Academy in 1881 and became a grand officer of the Legion of Honour, member of the grand council administering the order.

Peace

Dunant, Jean Henri, b.—May 8, 1828, Geneva, d.—October 30, 1910, Heiden, Switzerland. A humanitarian, founder of the Red Cross Organization, founder of Young Men's Christian Association (Y.M.C.A.). After witnessing the Battle of Solferino, in which there were over 40,000 casualties, Dunant organized emergency aid services for the war injureds. In *Un Souvenir de Solferino* he proposed the formation in all countries of voluntary relief societies for the prevention and alleviation of suffering in war and peace, without distinction of race or creed; he also proposed an international agreement covering the war wounded. In 1864, he founded the Red Cross organisation..In the same year the first national societies and the first Geneva Convention also came into being.

DUNANT, JEAN HENRI
Switzerland

He became bankrupt because he neglected his personal affairs. Dunant left Geneva in 1867 and spent most of the rest of his life in dire poverty and obscurity. He continued to promote interest in the treatment of prisoners of war, the abolition of slavery, international arbitration, disarmament and a homeland for Jews. In 1895, a German journalist relocated him at Heiden. Dunant received many honours and annuities, and shared the prize with Passy of France.

◆

Passy, Frédéric, b.—May 20, 1822, Paris, d.—June 12, 1912, Paris. An economist and an advocate of international arbitration. After serving as auditor for the French Council of State, he devoted himself to writing, lecturing, and organizing on behalf of various economic reforms and philanthropies. An ardent free trader, he belonged to the 19th century liberal tradition of the British economists Cobden and Bright both of whom he knew personally.

PASSY, FRÉDÉRIC
France

Passy's work for peace began during the Crimean War. His plea for peace in the periodical *Le Temps* helped to avert war between France and Prussia over Luxembourg. In the same year he founded the *Ligué Internationalé de la Paix,* later known as the *Societe Francaise pour l' Arbitrage entire les Nations*. After the Franco-German War he proposed independence and permanent neutrality for Alsace-Lorraine. As a member of the French Chamber of Deputies, he successfully urged arbitration of a dispute between France and the Netherlands concerning the boundary between the French Guiana and Surinam. He assisted in founding the International Parliamentary Union and remained active in the peace movement for the rest of his life.

Note: The peace prize for 1901 was divided equally between Dunant and Passy.

1902

PHYSICS

Lorentz, Hendrik Antoon / Zeeman, Pieter

CHEMISTRY

Fischer, Hermann Emil

PHYSIOLOGY OR MEDICINE

Ross, Sir Ronald

LITERATURE

Mommsen, Christian Matthias Theodor

PEACE

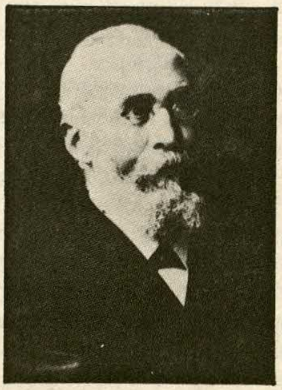
Ducommun, Elie / Gobat, Charles Albert

1902

Physics

In recognition of the extraordinary service they rendered by their researches into the influence of magnetism upon radiation phenomena.

Lorentz, Hendrik Antoon, b.—July 18, 1853, Arnhem, Netherlands, d.—February 4, 1928, Haarlem, Netherlands. The son of Lorentz, a nursery-owner, lost his mother when he was four. His father then married Luberta Hupkes. After completing his grade school where they had school hours not only in the morning and afternoon but also in the evening. Lorentz as a gifted pupil entered high school, the first in Arnhem, in 1866 in the third form. He entered the Leyden University in 1870 and obtained his B.Sc. degree in Mathematics and Physics in 1871. He returned to Arnhem in 1872 as a night school teacher and to prepare his doctoral thesis on the reflection and refraction of light. He got his doctor's degree in 1875 at the age of 22, and three years later was appointed to the Chair of Theoretical Physics at Leyden, especially created for him. He was invited to many Chairs abroad but chose to remain with his Alma Mater.



LORENTZ, HENDRIK ANTOON
The Netherlands

From the start of his scientific work, Lorentz took it as his task to extend J.C. Maxwell's theory of electricity and light, and his doctoral thesis was based on this. In 1878 he published an essay on the relation of velocity of light in a medium to the density and composition of the medium. Simultaneously but independent of Lorentz, a Danish physicist also named Lorenz had arrived at the same conclusions at Copenhagen. The resulting formula came to be known as the Lorentz-Lorenz formula.

Lorentz also made fundamental contributions to the study of the phenomena of moving bodies and in his treatise on the aberration of light and problems arising from it, he followed A.J. Fresnel's hypothesis that "ether" was immovable and it freely penetrates all bodies.

Lorentz was also responsible for the conception of electron—the electrically charged particle which plays an important role in the electromagnetic phenomena in 'ponderable' or tangible matter—and made it possible to apply the molecular theory to the theory of electricity and to explain the behaviour of light waves passing through moving, transparent bodies. Although, according to Maxwell's theory, electromagnetic radiation is produced by the oscillation of electric charges, the charges that produce light were unknown. Since it was generally believed that an electric current was made up of charged particles, Lorentz theorized that the atoms of matter might also consist of charged particles and suggested that the oscillations of these charged particles inside the atom was the source of light. If this were true, then a strong magnetic field should have an effect on these oscillations, and therefore, on the wavelength of the light thus produced.

In 1896, Zeeman, a pupil of Lorentz, successfully demonstrated this phenomenon which came to be called the "Zeeman effect". In 1902 both the teacher and the pupil were awarded the Nobel Prize for their efforts.

In 1905, he was made a Foreign Member of the Royal Society and awarded its Copley Medal in 1918. In 1912, he became Curator of Teyler's Physical Cabinet and Secretary of the *Hollandshe Maatschappij der Wesenschappen* (Dutch Society of Sciences), but continued as Extraordinary Professor at Leyden, delivering his famous Monday morning lectures for the rest of his life. In 1919, he was appointed Chairman of the Committee which was entrusted with the study of the movement of sea water that might result from the reclamation of the Zuyderzee in the Netherlands, a landmark in hydraulic engineering. His theoretical calculations, based on eight years of pioneering work, were confirmed in actual practice and have since become invaluable to the science of hydraulics.

The "Lorentz transformation, 1904" which explained the slight alterations in the electromagnetic forces between charges caused by their motion, resulting in minute contraction in the size of moving bodies, not only adequately explained the absence of relative motion of the earth with respect to ether in the Michelson-Morley experiments (to calculate the speed of light), but also paved the way for Einstein's special theory of relativity.

In 1923 he was elected a member of the International Committee of Intellectual Cooperation of the League of Nations, consisting of only seven of the world's most eminent scholars, and became its President in 1925. He remained Chairman of the Solvay Congress until his death. Lorentz is also remembered in his country for his initiative in emphasizing the importance of science in national production, which led to the creation of the Organization on Applied Scientific Research.

Lorentz married Aletta Catharina Kaiser, daughter of J.W. Kaiser, Professor at the Academy of Fine Arts and Director of *Rijksmusseum* (National Gallery) of Amsterdam, and better known as the designer of the first postage stamps of the Netherlands, in 1881. They had two daughters and one son, the eldest daughter Dr Geertruida Luberta Lorentz is a physicist in her own right.

◆

In recognition of the extraordinary service they rendered by their researches into the influence of magnetism upon radiation phenomena.

Zeeman, Pieter, b.—May 25, 1865, Zonemaire, Netherlands, d.—October 9, 1943, Amsterdam. Pieter was the son of Catharinum Forandinus Zeeman, a clergyman and *nee* Wilhelmina Worst. He had his secondary school education at Zierikzee, the main town of the island of Schouwen, and went to Delft for two years to receive tuition in the classical languages before entering university. His talent for natural sciences first became apparent when in 1883, while still attending the secondary school, he gave an apt description and drawing of the aurora borealis—then clearly observed in his country, which was published in *Nature*.

ZEEMAN, PIETER
The Netherlands

Zeeman entered Leyden University in 1885 and became a pupil of Kamerlingh Onnes (who won the Nobel Prize for Physics in 1913) and Hendrik A. Lorentz (with whom he was to share the Nobel Prize for Physics in 1902). In 1890 he was appointed assistant to Lorentz to participate in an extensive research programme which included the study of 'Kerr effect' (the splitting up of light into a spectrum when reflected by a magnetic mirror), which was to form the basis of his great work. In 1892, his first treatise, *Measures relatives du phenomene de Kerr,* won the Gold Medal from the Dutch Society of Sciences at Haarlem. After obtaining his doctor's degree in 1893 on the same subject, he joined F. Kohlrausch's Institute at Strasbourg, where he worked under E. Cohn for one semester. He returned to Leyden in 1894 and was *'privaatdocent'* from 1895 to 1897. He became a lecturer in Amsterdam University and was appointed Extraordinary Professor in 1900. When Van der Waals retired at the age of 70, Zeeman was chosen as his successor, at the same time functioning as Director of the Physics Laboratory. In 1923 a new laboratory, now known as the Zeeman Laboratory, was especially erected for him—the main feature being a concrete block weighing a quarter of a million kilograms free from the floor for vibration free experiments.

His principal interest and work was the study of the influence of magnetism on the nature of light radiation, which he started in the summer of 1896. In August 1896, Zeeman exposed the sodium flame to a large magnetic force, by placing it between the poles of a strong electromagnet. He studied the radiation of the flame by means of Rowland's mirror (a polished concave metal mirror with a large number of grooves, say 50,000, over a width of 1 cm., scratched on by means of a diamond). The observations were made in the direction perpendicular to the lines of force. Each line, which in the absence of the effect of the magnetic forces was very sharply defined, had now broadened. This indicated that not only the original oscillations, but also others with greater as also smaller oscillations were being radiated by the flame. Doubling the results, the light source in the direction of the magnetic force was studied, the poles of the magnet were perforated; the results were also confirmed in the direction of the magnetic lines of force. The reverse phenomenon, i.e., the absorption of light in sodium vapour was also studied and gave expected results. Professor Lorentz's theory that a strong magnetic force would affect the wavelength of light was further verified with other substances such as cadmium. The effect itself is referred to as the 'Zeeman Effect' for which discovery both Lorentz and Zeeman were awarded the Nobel Prize. This great work led to the calculation of the ratio of the mass and charge of the light-exciting particles, which was not possible until then.

Zeeman extended the physical concept to celestial phenomena and said that the existence of strong magnetic fields on the surface of the sun could be verified, since these should alter spectral lines derived from the celestial body. In 1908, this was confirmed by G.E. Hale, astronomer and Director of Mount Wilson Observatory in his photographs which showed that solar vortices the spectral lines indeed appeared to be affected by magnetic fields. Hale also confirmed subsequently Zeeman's theoretical prediction of the interrelationship between the directions of polarization and those of the magnetic fields. Zeeman also did laudable work on the Doppler effect in optico and in canal rays, on the study of propagation of light in moving media, and on the influence of the magnetic moment of the nucleus on the hyperfine structure of spectral lines. With J.de Gier, he succeeded in discovering a number of isotopes (for example 38 Ar, 64 Ni) with the help of Thomson's parabola mass spectrograph.

Zeeman was awarded honorary doctorates from many universities such as Göttingen, Oxford, Philadelphia, Strasbourg, Liege, Ghent, Glasgow, Brussels and Paris, and was honorary member of many distinguished academies. He was appointed member of the Royal Academy of Sciences of Amsterdam in 1898 and was the Secretary of the Mathematical-Physical Section from 1912 to 1920. Among his many distinctions are the Rumford Medal of the Royal Society of London, the Prix Wilde of the Academie de Sciences, Paris, the Baumgärtner-Preis of the Akademie der Wissenschaften of Vienna, the Matteucci Medal of the Italian Society of Sciences, the Franklin Medal of the Franklin Institute of Philadelphia, the Henry Draper Medal of the National Academy of Sciences of Washington. He was also made a Knight of the Order of Orange-Nassau and Commander of the Order of the Netherlands Lion.

In 1895, Zeeman married Johanna Elisabeth Lebret. They had one son and three daughters. He showed much interest in literature and the stage. He died after a short illness on October 9, 1943.

Note: The 1902 prize for Physics was awarded jointly to Lorentz and Zeeman.

Chemistry

In recognition of the extraordinary services he has rendered by his work on sugar and purine syntheses.

Fischer, Hermann Emil, b.—October 9, 1852, Euskirchen, near Bonn, Germany, d.—July 15, 1919, near Berlin. His father was a businessman and against his parents' wishes, Fischer left a business career and studied chemistry under F.A. Kekulé in Bonn. He then worked under J.F.A.von Baeyer (Nobel Laureate) in Strasbourg and Munich. He became a Professor of Chemistry in Erlangen in 1882, and Würzburg in 1885 and succeeded A.W.von Hoffman in Berlin in 1892. His marriage ended with the early death of his wife, and two of his three sons were killed in World War I. His health was affected by mercury and phenylhydrazine poisoning.

Fischer was essentially a practical chemist. His discovery of phenylhydrazine in 1875 provided a key to the complex problems of carbohydrate chemistry. He worked with his cousin Otto Fischer (1852-1932) in Munich on the structure of the triphenyl-methane dyestuffs.

While he was in Erlangen, Fischer began his studies on the constitution and synthesis of natural products. He published a series of papers on the chemistry of the heterocyclic nitrogen compounds related to uric acid, which he called "purines", and by 1897 established purine chemistry. In 1898 he synthesized purine itself.

FISCHER, HERMANN EMIL
Germany

Fischer discovered that phenylhydrazine forms well-defined crystalline derivatives with sugars, enabling them to be characterized and separated from otherwise intractable syrups. In 1890 he synthesized d-glucose and some other sugars from acrolein dibromide. In 1891 he discovered 'epimerization', and later stated the configurations of the sixteen possible aldohexoses. He synthesized a nucleotide for the first time in 1914, and, using his synthetic sugars, did some fundamental work on the specificity of enzymes. Fischer was able to devise a workable, though laborious, method for rejoining amino-acids through amide links. One of the polypeptides containing eighteen amino acids, which he synthesized in 1907, had a general resemblance to natural proteins.

During the war, he was active as an adviser to the government, especially on such matters as "synthetic" food. He was a simple and hard-working man who was greatly respected. Fischer is perhaps the greatest of organic chemists. He played a leading role in the establishment of the Kaiser Wilhelm Institute which later became the chain of Max Planck Institutes for research in various branches of science.

Physiology or Medicine

For his work on malaria, by which he has shown how it enters the organism and thereby has laid the foundation for successful research on this disease and methods of combating it.

Ross, Sir Ronald, b.—May 13, 1857, Almora, India; d.—September 16, 1932, Putney Heath, London. Eldest child of (General Sir) Campbell Claye Grant Ross, Indian Army, and his wife, Matilda Charlotte, daughter of a London lawyer. He was educated at Springhill, near Southampton, and St. Bartholomew's Hospital, from where he obtained the MRCS (1879) and LSA (1881). Thereafter he joined the Indian Medical Service and served with the Indian Army during 1881-94 in Madras and Burma. In 1889 he married Rosa Bessie, daughter of Alfred Bradley Bloxam, and they had two sons and two daughters. In 1894, while on leave in London, he met Sir Patric Manson and under his influence and counsel started working on the cause of malaria. Two years after his return to India, he discovered the malarial parasite in the gastro-intestinal tract of the Anopheles mosquito (1897). A year later, he discovered that a parasite in the blood of birds closely resembled the malarial parasite of humans. He came to the conclusion that human malaria was transmitted the same way. The entire research was done in a small laboratory in the

Presidency General Hospital (now known as the SSKM Hospital), Calcutta.

In 1899 Ross went to London and worked in the Liverpool School of Tropical Medicine first as a lecturer (1899-1902) and then as a Professor (1902-12). His research mainly was on the eradication of the malarial vector Anopheles mosquito. He became a physician for Tropical Diseases at King's College Hospital, London, and also Professor of Tropical Sanitation at Liverpool. He was appointed as a Consultant in Malaria to the War Office in 1917 and became the first Director-in-Chief of the Ross Institute and Hospital for Tropical Diseases that was founded in his honour.

ROSS, Sir RONALD
Great Britain

Ross, by his untiring efforts, disproved the view that malaria was contracted from air or water, although he did not work out the cycle of malarial parasite in the human systems. He also added materially to the knowledge of malarial epidemiology in the later part of his life. He always acknowledged his debt to Manson. His publications include *Prevention of Malaria* (1910) and his *Memoirs* (1923). He edited *Science Progress* from 1913 to 1932.

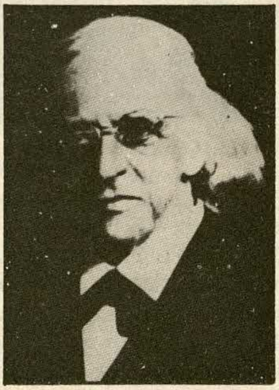
He was elected FRS in 1901, was appointed CB in 1902 and KCMG in 1911. He also received many honorary degrees and professional honours. He was also a versatile poet and his poem on Anopheles mosquito is reproduced below:

The day relenting God
Hath placed within my hand
A wondrous thing: And God
be praised at his command.
Seeking his secret deeds,
With tears and toiling breath,
I find thy cunning seeds
O, million-murdering Death.
I know this Little thing
A myriad men will save
O Death where is thy sting?
Thy victory, O Grave?

Literature

The greatest living master of the art of historical writing, with special reference to his monumental work, A History of Rome.

Mommsen, Christian Matthias Theodor, b.—November 30, 1817; d.—November 1, 1903. He came from the small North German town of Garding. His father was the assistant minister of the Protestant communities of Garding and Odesloe and he taught Theodor Greek, Latin, French and English in addition to the German and Danish spoken in the province.



MOMMSEN, CHRISTIAN MATTHIAS THEODOR, Germany

At Kiel, he later learnt Swedish and Italian and assimilated all that was worthwhile in the culture, both ancient and modern of the Western world. First trained as a lawyer, he was constantly attracted, at the same time, to ancient history and politics. In 1852, he became Professor of Roman Law in Zürich. In 1854, he moved to Breslau to take up a corresponding position. In 1858, he became Professor of ancient history at the University of Berlin.

Fame came his way soon after the publication of his first three volumes on Roman history entitled *Römische Geschichte* (1854-56). His additional comprehensive works like *Die Geschichte des Römischen Münzwesens* (History of the Roman Coinage, 1860), *Corpus Juris Civilis* (1870) and *Römisches Staatsrecht* (Roman Public Law, 1876) were the results of his initial efforts.

He was also a great philologist and is remembered for his work *Die Unteritalische Dialekte* (The Dialects of Southern Italy, 1850).

Peace

DUCOMMUN, ELIE
Switzerland

Ducommun, Elie, b.—February 19, 1833, Geneva, d.—December 7, 1906, Bern. A writer and editor, he worked in Geneva and Bern, and spent most of his career as general secretary of the Jura-Simplon Railway. His spare time was spent on peace activities. He took an active part in the movement for European union, editing *Les Etats-Unis d' Europe,* official organ of the International League of Peace and Freedom. In 1899, Ducommun participated in the first regular International Peace Congress. Two years later he became honorary general secretary of the newly founded International Peace Bureau. After 1895, he published the bureau's *Correspondence bimensuelle.* In this period he published a number of works on peace movement.

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Gobat, Charles Albert, b.—May 21, 1834, Tramelan, Switzerland, d.—March 16, 1914, Bern. A politician, administrator, philanthropist, and author, he succeeded Ducommun as director of the *Bureau International Permanent de la Paix,* which received the Nobel Peace Prize in 1910. Gobat first practised law in Bern and then at Delemont in Bern canton. He also lectured on French civil law at the Sorbonne. In the late eighties he was active in cantonal and national politics and public administration, and in 1890 he became a member of the Swiss Federal Council.

GOBAT, CHARLES ALBERT
Switzerland

Gobat worked with the Inter-Parliamentary Union, founded by Cremer (recipient of the Nobel Prize for Peace in 1903) since its inception in 1888. In 1892, Gobat was president of the union's fourth conference, which was held in Bern and which founded the *Bureau Interparlementaire.* He served as general secretary of the bureau, an information officer dealing with peace movements, international conciliation, and communication, among national parliamentary bodies. Among Gobat's books on international affairs and history *Le Cauchemar de l' Europe* (The Nightmare of Europe) is very well known.

Note: The prize was divided equally between Ducommun and Gobat.

1903

PHYSICS

Becquerel, Antoine Henri
Curie, Marie / Curie, Pierre

CHEMISTRY

Arrhenius, Svante August

PHYSIOLOGY OR MEDICINE

Finsen, Niels Ryberg

LITERATURE

Bjornson, Bjornstjerne Martinus

PEACE

Cremer, Sir William Randal

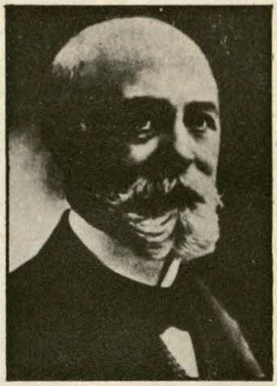
1903

Physics

In recognition of the extraordinary services he has rendered by his discovery of spontaneous radioactivity.

Becquerel, Antoine Henri, b.—December 15, 1852, Paris, d.—August 25, 1908, Le Croisic. Becquerel was brought up in a family dedicated to scientific research. His grandfather was a distinguished physicist during the time of Napolean Bonaparte and his father had continued the family tradition. Becquerel's father specialized in the study of fluorescence and Becquerel began his own research, continuing his father's investigations into fluorescence. He received his scientific education at the *Ecolé Polytechniqué* and engineering training at the *Ecolé des Pouts et Chaussees*. In 1888 he was awarded his doctorate for a thesis on the absorption of light, and the following year became a member of the *Academie des Sciences*. He was appointed Professor at the Museum of Natural History in 1892, and at the *Ecolé Polytechniqué* in 1895. He was a member of the Royal Society of London and many scientific societies abroad.

Intrigued by Röntgen's discovery of X-rays, Becquerel was naturally led to an investigation of the capacity of these rays for exciting fluorescence. He wondered whether fluorescing bodies can themselves produce X-rays or cathode rays, and to verify this he examined certain salts of uranium called potassium uranyl sulfate, which have remarkable capacity to fluoresce. On developing a photographic plate placed beneath a quantity of the uranium salt wrapped in metal foil, he discovered a blackening of the plate at a point corresponding to the position of the uranium salt. After repeated experiments, Becquerel realized that the radiation was being emitted by the substance independent of its fluorescence.



BECQUEREL, ANTOINE HENRI
France

In 1899 Becquerel showed that the radiation could be deflected by a magnetic field and that therefore it consisted, in part at least, of tiny charged particles. This meant that the radiation was not X-rays. Later on other elements were shown to emit these rays, important among them being radium, discovered in 1898 by Marie and Pierre Curie. Marie Curie named Becquerel's radiation "radioactivity", similar to X-rays but more powerful and are today known as gamma radiation. His work was repeated and confirmed by other scientists, including William Thomson.

For his discovery of radioactivity, Becquerel shared the Nobel Prize for Physics with Pierre Curie and Marie Curie. He successfully demonstrated the influence of the earth's magnetic field on its atmosphere in 1894 and also investigated the absorption of light by crystals (1886-88). ◆

In recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor

Henri Becquerel.

Curie, Marie, (Sklodowska), b.—November 7, 1867, Warsaw, Poland; d.—July 4, 1934, Paris. She was the youngest child of a family of five. Her father a teacher of mathematics and physics, had to struggle hard to keep together his home on his slender income. When Marie was nine her mother died, and this tragedy no doubt helped to develop that wonderful power of overcoming difficulties which characterized her whole life. When she reached the age of seventeen, Marie became governess to a landed gentleman's children. She held this post for five years, but all the time she longed to study science, a burning desire obviously inherited from her father.

CURIE, MARIE, nee SKLODOWSKA
France

Marie left her home in Warsaw in 1891 to pursue her consuming interest in science. She reached Paris where she enrolled as a student. Her funds were so inadequate that she suffered incredible hardships, living in an attic without proper food or fuel. She worked at the university during the day and studied in her attic far into the night, preparing for the various examinations. In 1894, shortly after graduation, she met the talented young French Chemist, Pierre Curie, and a year later, they were married. After their marriage, Marie worked in her husband's laboratory. Thus began a remarkable partnership which has so enriched the world. About this time a French scientist named Henri Becquerel noted that the salts of uranium emitted a sort of rays. The Curies were excited by this news. When they started their own research they found that certain substances were emitting far more radioactivity than could be accounted for by the quantity of uranium in them. The mineral ore pitchblende which emitted a high degree of radiation was refined by them. With the refining of the ore in 1898 they were rewarded by the discovery of a totally new element which they named "Polonium", in honour of Marie's homeland. Polonium, although a hundred times more radioactive than uranium, could not still account for all the radiation emitted from pitchblende. They were convinced that an even more intensely radioactive element must be present and called this unknown element "radium". The Curies required a large quantity of pitchblende for refining to get radium. They spent all their life savings on buying this which fortunately for them were available in huge quantities from the vast heaps of Czechoslovakian ore mines. Marie and Pierre began their gruelling work in a leaky shed near their lodging. They worked hard for the next four years with little money left for food. Their determination and will to succeed saw them through the hardships. In 1902, refining of tons of pitchblende gave about a tenth of a gram of radium.

In 1903 Marie and Pierre were awarded the Nobel Prize for Physics. They were too ill and exhausted to personally accept the award. The award renewed their, especially Marie's, fascination for the vast quantity of energy pouring from radium atoms. But, in 1906 tragedy struck. A road accident robbed her of her husband. Marie's unique courage stood with her. She took over her husband's Professorship at the Sorbonne, the first woman to hold that post, and continued her research and teaching. In 1911 she was awarded the Nobel Prize for Chemistry and became the first person to have ever received two of this coveted prize.

Marie in her last years of life was attached to the Paris Institute of Radium which later became a major research centre for nuclear physics and chemistry. She pioneered some of the earliest medical applications of X-rays and radium. Even to this day radium therapy remains one of the major treatments for cancer. Ironically as fate would have it, her close association and constant exposure to radioactivity affected her blood and she died of leukaemia, blood cancer, in 1934.

Marie Curie is remembered not just for the discoverv of radium and her contribution to modern understanding of the atom. Her name symbolises spirit of dedication and commitment rarely equalled in the history of science. ◆

In recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel.

Curie, Pierre, b.—May 15, 1859, Paris, d.—April 19, 1906, Paris. The second son of a physician, Pierre was educated privately and at the Sorbonne, where he became an assistant in 1878. In 1882 he was made Chief of the Laboratory at the School of Industrial Physics and Chemistry, where he remained until he was appointed Professor of Physics at the Sorbonne in 1904. In 1894 he met Marie Sklodowska and married her the following year. From early 1898 they worked together on the study of radioactivity of radium.

CURIE, PIERRE
France

Pierre Curie's scientific career falls into two periods, the time before the discovery of radioactivity by Henri Becquerel, when he worked on magnetism and crystallography, and the time after when he collaborated with his wife Marie Curie on this new phenomenon. In 1880 with his brother Jacques he discovered Piezoelectricity. "Piezo" comes from the Greek for "to press", and refers to the fact that certain crystals when mechanically deformed will develop opposite charges on opposite faces. The converse will also happen, i.e. an electric charge applied to a crystal will produce a deformation. The brothers used the effect to construct an electrometer to measure small electric currents. Marie Curie later used the instrument to investigate whether radiation from substances other than uranium would cause conductivity in air. Pierre Curie's second major discovery was on the effect of temperature on the magnetic properties of substances, which he was studying for his doctorate. In 1895 he showed that at a certain temperature specific to a substance, it will lose its ferromagnetic properties; this critical temperature is now known as the "Curie-point". Shortly after this discovery he began to work intensively with his wife on the new phenomenon of radioactivity. Two new elements, radium and polonium, were discovered in 1898. The rays these elements produced were investigated and enormous efforts were made to produce a sample of pure radium. In 1903, he shared the Nobel Prize for Physics with his wife on the new phenomena of radiation.

Pierre Curie received little recognition in his own country. He was initially passed over for the chairs of Physical Chemistry and Minerology in the Sorbonne and was defeated when he applied for membership of the *Academie* in 1902. He was, however, later admitted to the *Academie* in 1905. The only reason he seems to have been given the Chair in 1904 was that he had been offered a post in Geneva and was seriously thinking of leaving France. This may, partly, have been because his political sympathies were very much to the left, and, because he was unwilling to participate in the science policies of the Third Republic. Pierre Curie was possibly one of the first to suffer from radiation sickness. No attempts were made in the early days to restrict the levels of radiation received. His ill health, together with the demands of his new post, restricted his scientific activity. He was tragically killed by a wagon in a Paris street in 1906.

After his death, his wife published his collected works and he was honoured in many ways. In 1910, the Brussels Conference on Radioactivity named the unit of radioactivity after him.

Note: The prize was divided; one half being awarded to Becquerel; the other half jointly to Marie and Pierre Curie.

Chemistry

In recognition of the extraordinary services he has rendered to the advancement of chemistry by his electrolytic theory of dissociation.

Arrhenius, Svante August, b.—February 19, 1859, Vik, Sweden, d.—October 2, 1927, Stockholm. Svante Arrhenius is one of the founders of physical chemistry. His ionic theory helped immensely in the understanding of the structure of chemical compounds and their behaviour in solution.

Arrhenius came of a Swedish farmer family. His father was an estates manager. He went to Uppsala University with the intention of studying chemistry. Since chemistry was badly taught, he studied physics. At Uppsala, however, it was then only possible to do research on light which he did not wish to do. In 1881 he migrated to Stockholm to work under Professor E. Edlund on the study of solutions and electrolytes. During his education in Uppsala, while still an undergraduate, Arrhenius began to formulate the ionic theory. He wondered what property of a compound determined whether it would conduct electricity when dissolved in water. He firmly believed that the answer lay in the structure of the compound itself.

ARRHENIUS, SVANTE AUGUST
Sweden

In 1883 Arrhenius came out with a simple but revolutionary answer. He said the structure of the compounds that conduct electricity in solution, i.e. electrolytes, differed from other compounds. These electrolytes he said were made up of tiny charged particles called ions. The attractive force between these positive and negative ions held them together in the solid form of the compound. These ions dissociated while in solution and moved about freely. During electrolysis, the positive ions moved towards the negative electrode and the negative ions towards the positive electrode. This movement of ions caused the flow of electric current typical of electrolysis.

Arrhenius could not explain the decomposition of compounds during electrolysis. He assumed that ions were electrically charged atoms and these during electrolysis moved towards the electrodes to become neutral atoms of the element. He could neither explain the mechanism by which an atom could acquire a charge. He was however convinced of the validity of his theory and submitted his thesis in 1884. To his bitter disappointment, the distinguished chemist Per Cleve who was Arrhenius' tutor and one of the examiners had made up his mind against the ionic theory and awarded him the lowest possible grade.

Arrhenius was not easily silenced. He sent copies of his work to R.J.E. Clausius, Lothar Meyer, W.F. Ostwald and J.H. Van't Hoff, who were all impressed by his thesis. After presenting his thesis he spent five years going round Europe, supported by a travelling scholarship from the Swedish Academy of Science, and worked with Ostwald, F.W.G. Kohlrausch, L. Boltzmann and Van't Hoff. This gave him the time and the facilities to refine and develop his theory.

The discovery of the electron in 1897 by J.J. Thomson (Nobel Laureate for Physics, 1906), an English physicist, and the discovery of radioactivity by Henri Becquerel (Nobel Laureate for Physics, 1903), in Paris at about the same time gave the explanation for Arrhenius' idea of charged atoms. For example, if an atom of sodium were to lose an electron, i.e., one unit of negative charge, the atom would assume an overall positive charge, and, if an atom of chlorine acquired an extra electron, it would assume an overall negative charge. Sodium chloride, i.e., common salt, could therefore be regarded as an accumulation of sodium and chlorine ions bound together by the electrical attraction of positive and negative charges. Since electrons were part of the internal structure of atoms, their gain or loss would automatically change the properties of the atom. The

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dissociated ions of sodium and chlorine in salt water, therefore, show none of the properties of sodium, which reacts vigorously in water, or of chlorine, which is a poisonous greenish gas.

By 1887, Arrhenius was regarded abroad as one of the greatest chemists. The ionic theory became respectable and the scientific establishment in Sweden hastened to congratulate the man it had once rejected. He was awarded the Davy Medal of the Royal Society in 1902.

Per Cleve who in previous years had humiliated Arrhenius and opposed his ideas was among the panel of judges who chose him for the Nobel Prize. In 1905, he was appointed Director of the Nobel Institute for Physical Chemistry.

Physiology or Medicine

In recognition of his contribution to the treatment of diseases, especially lupus vulgaris, with concentrated light radiation, whereby he has opened a new avenue for medical science.

Finsen, Niels Ryberg, b.—December 15, 1860, Thorshavn, Faeroe Islands, Denmark, d.—September 24, 1904, Copenhagen. A physician, founder of modern phototherapy, he received the prize for the application of light in the treatment of skin diseases.

FINSEN, NIELS RYBERG
Denmark

While a student at the University of Copenhagen, he became interested in the effects of light on living organisms and in 1893 found that, lengthy exposure of the violet end of the spectrum prevents suppuration of the pustules, or formation of characteristic pockmarks. Aware of the bacteria-destroying effects of sunlight, he developed an ultraviolet treatment for *lupus vulgaris,* which met with great success. Although phototherapy has largely been superseded by other forms of radiation and drug therapy, Finsen's work did much to encourage the radiation therapy then being developed and led to the use of ultraviolet sterilization techniques in bacteriological research. Incidentally, it may be mentioned that the ancient Indian surgeon Susruta (Ca 600 B.C.) used to sterilize his surgical dressings and instruments by exposure to sunlight. Finsen's Medical Light Institute (now called the Finsen Institute) was founded in Copenhagen in 1896. He donated half of his share of the Nobel Prize to this Institute.

Literature

As a tribute to his noble, magnificent and versatile poetry, which has always been distinguished by both the freshness of its inspiration and the rare purity of its spirit.

Bjornson, Bjornstjerne Martinus, b.—December 8, 1832, Kvikne, Norway, d.—April 26, 1910, Paris. A Norwegian poet, dramatist, novelist, journalist, public speaker, theatrical director and one of the most prominent public figures of Norway in his time. He is identified with Ibsen, Alexander Kielland and Jonas Lis as one of the four greats of Norwegian literature of the 19th century. He was the son of a pastor and grew up in a small farming community of Romsdalen. His early novels include *Synnoeve solbakken* (1857).

His novels translated in English include *Trust and Trial* (1858); *Love Life in Norway* (1870); and *Sunny Hill* (1932). His one act play, *Mellem Slagene* (1857), was translated into English as *Between the Battles.* It was immediately followed by the tales *Arne* (1858, English 1866) and *En glad gut* (1860, The Happy Boy, 1869) as well as the play *Halte Hulda* (1858, Lame Hulda). He was a prolific writer and his later compositions are numerous. Some of the popular ones are: *Digte og sange* (1870, Poems and Songs, 1915), the epic poem *Arnljot Gelline,* (1870, English 1917).

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He left Norway in a self-imposed exile to seek freedom in expressing his views and wrote *En fallit* (1874, The Bankrupt, 1914), *Redaktoren* (1874, The Editor, 1914). The two dramas which followed were *Kongen* (1875, The King, 1914) and *Det ny system* (1879, The New System, 1913). His two later novels were *Det flager i byen og pa havnen* (1884, The Heritage of the Kurts, 1892) and *Pa Guds veie* (1889, In God's Way, 1890). *Paul Lange og Tora Parsberg* (1898) was based on the real life of Ole Richter, an unjustly condemned politician friend of Bjornson who committed suicide on June 15, 1888. *Nar den ny vin blomstrer* (1909, When the New Wine Blooms) was his last play. He also wrote the national anthem of Norway *"Ja, vielker dette Landet"* (Yes, We Love This Country).

BJORNSON, BJORNSTJERNE MARTINUS
Norway

Peace

Cremer, Sir William Randal, b.—March 18, 1838, Fareham, Wiltshire, d.—July 22, 1908, London. A trade unionist and pacifist who won the prize for his advocacy of international arbitration. He was one of the founders of the Amalgamated Society of Carpenters and Joiners, founded in 1860. He was secretary of the British Section of the International Working Men's Association but resigned because of a dispute with a leader.

CREMER, Sir WILLIAM RANDAL
Great Britain

During the Franco-German war he formed a Working Men's Committee to emphasize British neutrality. This group developed into the Workmen's Peace Association, of which he was secretary until his death. Cremer was a member of the House of Commons from 1885 to 1895 and from 1900 to 1908. He was knighted in 1907.

1904

PHYSICS
Rayleigh, Lord (John William Strutt)
CHEMISTRY
Ramsay, Sir William
PHYSIOLOGY OR MEDICINE
Pavlov, Ivan Petrovic
LITERATURE
Mistral, Frédéric
Echegaray Y. Eizaguirre, Jose
PEACE
Institut de Droit International
(Institute of International Law)

1904

Physics

For his investigations of the densities of the most important gases and for his discovery of argon in connection with these studies.

Rayleigh, Lord (John William Strutt), b.—November 12, 1842, Langford Grove, Essex, England, d.—June 30, 1919, Terling Place, Essex. His paternal grandparents were Colonel J.H. Strutt, Member of Parliament for Maldon, Essex, and Lady Charlotte Mary Gertrude, daughter of the first Duke of Leinster in whose favour was created the peerage in 1821. Rayleigh became the third Lord Rayleigh in 1873. He was first educated under a private tutor at Torquay and entered Trinity College, Cambridge, in 1861. In 1865 he graduated as First Wrangler and also got the first Smith's Prize. Elected to a Fellowship of Trinity, which he held until his marriage in 1871, his first papers explained the electromagnetic theory of James Clerk Maxwell in terms of analogies that a layman could understand. In 1877, on an excursion to Egypt taken because of his health, he wrote *The Theory of Sound.* In 1879, he succeeded James Clerk Maxwell as Cavendish Professor of Experimental Physics at Cambridge University. In the Cavendish laboratory, he successfully established various courses in experimental physics, and he himself was an experimentalist of great ability who could get valuable results from simple apparatus. Although he only had half a dozen students in his classes initially, the number rose to seventy by the time he retired in 1884 and by 1892 the number was double. After 1884, however, his researches were mainly carried out in a private laboratory at his home in Terling. After retiring from Cambridge, Rayleigh succeeded John Tyndal as Professor of National Philosophy from which position he resigned in 1905. He was elected President of the Royal Society in 1905 and became the Chancellor of Cambridge University in 1908.

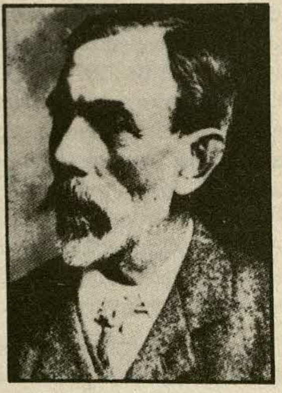
RAYLEIGH, Lord (JOHN WILLIAM STRUTT)
Great Britain

Rayleigh was awarded the prize for his successful isolation of argon, an inert gas. The same year his collaborator Sir William Ramsay was awarded the Nobel Prize for Chemistry for his discovery of inert gaseous elements in the atmosphere and determining their place in the periodic table. Rayleigh's prize was also in recognition of his extremely accurate measurements of the density of the atmosphere and its constituent gases which, incidentally, led to the discovery of argon and of other inert gases forming a new family of chemical elements. His experiments at Cambridge also concerned establishing electrical units of resistance, current and electromotive force, optics, sound and surface tension. His fundamental discoveries in the fields of acoustics and optics are basic to the theory of wave propagation in fluids. He also brought to general notice the work of J.J. Waterson on the kinetic theory of gases, which was hitherto overlooked. He was however critical of the quantum theory enunciated by Max Planck which he found difficult to accept.

Chemistry

In recognition of his services in the discovery of the inert gaseous elements in air, and his determination of their place in the periodic system.

Ramsay, Sir William, b.—October 2, 1852, Glasgow (Scotland); d.—July 23, 1916, Surrey, England. Ramsay, the son of an engineer, had a conventional education since he was intended to be a theologist. But he was single-minded in making a career out of chemistry. A student of the German analytical chemist Bunsen at the University of Heidelberg, he became Professor of Chemistry at the University of Bristol, and later at the University of London.



RAMSAY, Sir WILLIAM
Great Britain

Among his early studies was the physiological action of alkaloids, establishing their relationship to *pyridine,* a nitrogen-containing organic compound closely resembling *benzene* in chemical structure. In 1892, the British physicist Lord Rayleigh questioned chemists to explain the cause for the difference in the atomic weight of nitrogen found in chemical compounds and the heavier free nitrogen found in the atmosphere. Ramsay predicted that nitrogen, isolated from the atmosphere, was consistently contaminated with hitherto undiscovered heavy gases. Devising a method that assured total removal of nitrogen and oxygen from air, Ramsay and Rayleigh found a chemically inert gaseous element, later called *argon,* comprising nearly one per cent of the atmosphere. The following year, Ramsay liberated *helium* from the mineral clevite and later demonstrated that the lightest of the inert gases is continually produced during the radioactive decay of radium—a discovery of crucial importance for the understanding of nuclear reactions.

The positions of *helium* and *argon* in the Periodic Table of Elements indicated that at least three more noble gases should exist. Ramsay and the British chemist Travas isolated these elements called *neon, krypton,* and *xenon* from air brought to a liquid state at low temperature and high pressure. Ramsay detected the presence of the last of the noble gas series called *niton (radon),* in the radioactive emissions of radium.

Ramsay's discoveries brought him international fame. He was elected Fellow of the Royal Society in 1888 and knighted in 1902.

His writings include *A System of Inorganic Chemistry* (1891), *The Gases of the Atmosphere* (1896), *Modern Chemistry,* in two volumes (1900), *Introduction to the Study of Physical Chemistry* (1904) and *Elements and Electrons* (1913).

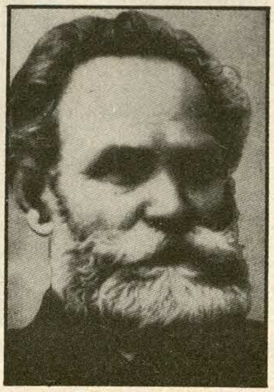
Physiology or Medicine

In recognition of his work on the physiology of digestion, through which knowledge on vital aspects of the subject has been transformed and enlarged.

Pavlov, Ivan Petrovic, b.—September 26, 1849, Ryazan, Russia; d.—February 27, 1936, Leningrad. He came from a poor, peasant family. He studied chemistry and physiology at the University of St. Petersburg (now Leningrad) and received his M.D. from the Russian Imperial Medical Academy in 1883. He then spent two years in Germany studying the blood system and the physiology of digestion. He was interested in the brain control on these two aspects of bodily function.

On his return to Russia, Pavlov began research on cardiovascular system. In 1890 he was appointed Professor of Physiology at the Imperial Medical Academy, where he started a series of experiments with dogs. In addition, in 1891, he became Director of Physiology at the St Petersburg Institute for Experimental Medicine and remained there for forty-five years. He was also incharge of the physiology laboratory of the St. Petersburg Academy and remained its head for thirty years. The Soviet Government eventually provided him with a splendid laboratory at Koltushig, about thirty miles from Leningrad.

In 1888, Pavlov discovered the secretory nerves to the pancreas. While experimenting with dogs, he found that when a dog was fed, and the food dropped out through the tube in the food-pipe, the stomach still secreted gastric juices, which could be collected from the tube in the stomach. He elucidated the role of the vagus nerve in the secretion of gastric glands and the constancy of gastric juice acidity. He was able to explain three phases of digestion—nervous, pyloric and intestinal. He confirmed the discovery of W.M. Bayliss and E.H. Starling that a hormone secretion is responsible for inducing pancreatic secretion. His studies on digestion was published in *Die Arbeit der Verdauungsdrusen.*



PAVLOV, IVAN PETROVIC
Russia

He found that if a dog was given food and simultaneously a bell was rung at several minutes intervals, the dog eventually salivated at the sound of the bell, even if no food was present. He thus demonstrated that the dog's nervous system had learnt to associate the sound of the bell with food. Pavlov called this behaviour the "conditioned" reflex and the process of learning it "conditioning". Pavlov also demonstrated that a dog that has never been fed meat and hence has never seen it will show no response to it, since it has not learned to associate it with food.

One of Pavlov's significant discoveries was that the area of the brain responsible for this reflex is found only in higher animals. He tried to apply these observations to human behaviour and theorized that many of the everyday responses are conditioned reflexes.

Pavlov's "conditioned reflex" has widespread influence on our knowledge of higher nervous function in the fields of physiology, psychology, psychiatry and education. It provides a valuable experimental technique for the analysis of cerebral function.

Pavlov continued his experiments with dogs until his death. Though he was an outspoken and vehement critic of Marxism and the Soviet system, he was very highly regarded in Russia. His homeland bestowed on him every possible national scientific honour. He was designated for the first Nobel Prize for Physiology and Medicine in 1901, but the Swedish Academy doubted the authenticity of his experiments since two Swedish Professors visited his laboratory in St. Petersburg and rejected him for the prize. After due verification of his experiments, however, he was eventually awarded the prize.

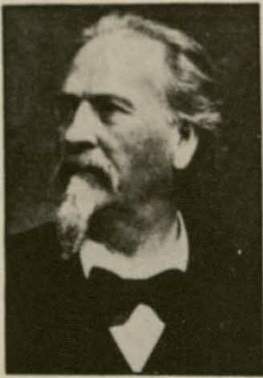
Literature

In recognition of the fresh originality and true inspiration of his poetic production, which faithfully reflects the natural scenery and native spirit of his people, and, in addition, his significant work as a Provencal philologist.

Mistral, Frédéric, b.—September 8, 1830, Maiano Maillane, now Bouches du Rhone, France, d.—March 25, 1914, Maillane. A poet who revived the Provencal language and literature in the 19th century. His father Francois Mistral was a well-to-do farmer devoted to the customs. He gave his son good education at the College Royal Avignon where he learned the works of Homer and Virgil and was profoundly impressed by them.

His teacher Joseph Roumanille, a poet himself, influenced him to write in his maternal language Provencal. He graduated in law from the University of Aix-en-Provence in 1851. He worked for almost twenty years on a dictionary of *langue d' oc, Lou Tresor dou Felibrige* (2 volumes, 1878). His literary output consists of *Li Provencalo*

(1852) and four long poems *Mireio* (1959), his masterpiece, *Calendau* (1867), *Nerto* (1884), *Lour pouemo dou Rose* (1897); a historical tragedy, *La Reino Jano* (1890); two volumes of lyrics, *dis Isclo d'or* (1876) and *Lis Oulivado* (1912). He wrote many short stories which were collected in *Prose d' Armana* (1926-1929, in three volumes). His memoirs *Moun espelido* (1906, English 1907) is his best known work.



MISTRAL, FRÉDÉRIC
France

The French Academy awarded him a prize four times. The Institute of France gave him the Reynaud prize of 10,000 francs, for his dictionary. The universities of Halle and Bonn conferred honorary doctorates on him. He shared the prize alongwith the Spanish playwright Jose Echegaray Eizaguirre.

◆

In recognition of the numerous and brilliant compositions which, in an individual and original manner, have revived the great traditions of the Spanish drama.

Echegaray Y. Eizaguirre, Jose, b.—April 19, 1833, Madrid, d.—September 14, 1916, Madrid. He studied at the *Instituto* in Murcia and afterwards in Madrid, where he became an engineer in the public works department and later a professor at the School of Roads and Bridges. Under King Amadeo of Savoy, he was made director of public works (1869-72), but the fall of King Amadeo sent him into temporary exile in Paris where he indulged in his keen passion for the theatre.

On return to Spain in 1874, he was appointed Minister of Finance and was instrumental in founding the Banco de Espana. *La hija natural* (The Illegitimate Daughter, 1865) is his first play, although *El libro talonario* (Book of Accounts, 1874) written under the pseudonym of Jorge Hayaseca is considered his first major play. *La ultima noche* (The Last Night, 1874), and *La esposa del vengador* (The Avenger's Wife, 1874) continued the neo-romantic tradition in Spanish drama and were followed by *En el puno de la espada* (The Sword's Handle, 1875), *O locura o' santidad* (Madman or Saint, 1877, considered his best play), *En el pilary en la cruz* (The Stake and the Cross, 1878), and *Conflicts entre dos deberes* (Conflict of Duties, 1882). These plays combine history and chivalrous adventure to create a melodramatic kind of hysterical fever oscillating between grandeur and caricature

ECHEGARAY Y. EIZAGUIRRE, JOSE
Spain

He was influenced by Henrik Ibsen which led to plays like *El gran Galeoto* (The Grand Galeoto, 1881), his greatest triumph, *Dos fanatismos* (Two Fanaticisms, 1887), *Son of Don Juan* (1892), *El loco Dios* (The Mad God, 1900). Other plays include *La Duda* (Doubt), *El estigma* (The Stigmata), *Mancha gue limpia* (Spot That Cleans), *Mariana, La desequilibrada* (The Disturbed Woman, 1904), *A fuerza de arrastrarse* (By Dint of Crawling, 1905). *La muerte en los labios* (Death on the Lips) is a play written on the life and death of Michel Servet, set in the gloom of Calvinist Geneva, in which Echegaray appeals to tolerance without unduly distorting history. Other writings include articles, essays on popular science published in *Gencia Popular* (1905) and *Vulgarizacion Gentifica* (Scientific Vulgarization, 1910) and *Recuerdos* (Memoirs, 1917).

Note: The prize was divided equally between Mistral and Eizaguirre.

Peace

INSTITUT DE DROIT INTERNATIONAL
(INSTITUTE OF INTERNATIONAL LAW)
Ghent

Institut de Droit International or **The Institute of International Law**, the recipient of the prize, was founded in 1873 as a private association of politicians and international jurists. The moving spirit behind its foundation was Dr Rolin Jaequemyns, who edited the *Revue de Droit International* from Ghent in Belgium. The aim of this institute was to investigate the guiding principles of international law, to attempt its codification, to discuss urgent international problems and, if possible, suggest ways and means of solving them.

The institute emphasized the importance of clarifying the difficulties in relation to the differences in legal interpretation and practice in various countries of the world and it offered its opinion in disputed cases. The institute laid down the general principle of international judicial proceedings. It published a book called *Hand Book of the Rules and Observances of Warfare* (1880). It is the first institution to receive the Nobel Peace Prize.

1905

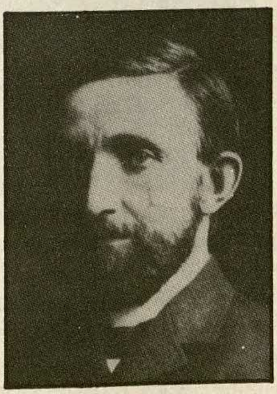
PHYSICS
Von Lenard, Philipp Eduard Anton
CHEMISTRY
Von Baeyer, Johann Friedrich Wilhelm Adolf
PHYSIOLOGY OR MEDICINE
Koch, Robert
LITERATURE
Sienkiewicz, Henryk
PEACE
Von Suttner, Baroness, Bertha Sophie Felicita

1905

Physics

For his work on cathode rays.

Von Lenard, Philipp Eduard Anton, b.—June 7, 1862, Pozsony (Pressburg) in Hungary, now Bratislava, Czechoslavakia, d.—May 20, 1947, Messehausen, Germany. He studied physics successively at Budapest, Vienna, Berlin and Heidelberg under Bunsen, Helmholtz, Konigsberger and Quincke. He got his Ph.D. in 1886 from Heidelberg. From 1892 Lenard worked as *Privatdozent* and assistant to Professor Hertz at the University of Bonn, appointed Professor Extraordinary at the University of Breslau in 1894, became Professor of Physics at Aix-la-Chapelle in 1895, Professor of Theoretical Physics at the University of Heidelberg in 1896 and Professor Ordinarius at the University of Kiel in 1898. He was married to Katharina Schlehner.



VON LENARD, PHILIPP EDUARD ANTON
Germany

Lenard's initial field of work was mechanics and he completed and published Professor Heinrich Hertz's *Principles of Mechanics* in 1894. His interest in phosphorescence and luminescence was with him since boyhood, when he, alongwith his schoolfellows, would warm flourine crystals to make them luminescent. He worked with astronomer W. Wolf on the luminosity of pyrogallic acid when mixed with alkali and bisulphite for developing photographs, discovering that the luminosity depended on the oxidation of pyrogallic acid. He also worked with V. Klatt, his first teacher in physics in his native town, on magnetism with bismuth and self-luminous substances such as calcium sulphide. At the Modern College at Pressburg, they found that calcium sulphide, after previous illumination, was not luminous if quite pure. but exerted light in the dark only if it contained at least some traces of heavy metals, such as copper and bismuth on which the colour, intensity and duration of luminosity depended. This work formed the beginning of work in a field which occupied him for the next 18 years.

Lenard did his initial work with cathode rays while working under Quincke at Heidelberg in 1888. Later, while working under Hertz at the University of Bonn, Hertz asked him to see the discovery made by him. A piece of uranium glass covered with aluminium foil and put inside the discharge tube became luminous when struck by cathode rays. Working on Hertz's suggestion, Lenard attempted to separate, by means of a thin plate of aluminium, two spaces, one in which the cathode rays were produced, and the other, where the rays could be observed in their pure form. He thus made his great discovery of the quartz in the old tube by a metal plate containing a small hole sealed with aluminium foil, sufficiently thick to withstand the airpressure but thin enough to allow the cathode rays to pass out. The glowing of the small grains of alkaline-earth phosphor fixed on the aluminium window and later above it confirmed that not only had the cathode rays passed out of the interior of the discharge tube but that they could pass through air of normal density. Using a phosphorescent screen he showed that the rays decreased in intensity as the screen was drawn away from the tube and they ceased at a distance. The experiments also demonstrated that the 'absorptive' power of substances to absorb the rays depended on their density not on their chemical nature, and that the absorption decreased with increasing velocity of the rays. Lenard at first believed that the cathode rays were propagated in ether, he abandoned this view in 1897 when the "corpuscular" nature of cathode rays was proved. He was awarded the prize for his research on cathode rays and the discovery of many of their properties.

Lenard also extended Hertz's work on the photoelectric effect. He showed that when ultraviolet light falls on a metal, it takes from the metal electrons which are then propagated in the vacuum, and their speed and path can be controlled by a magnetic field. By exact measurements he could show that the number of electrons projected was proportional to the energy of the incidental light but their speed and therefore the kinetic energy was independent of their number and varies inversely with the wavelength. His findings conflicted with existing theories and were not explained until 1905, when Einstein produced his quantitative law and developed the theory of quanta of light or photos. Lenard never forgave Einstein for discovering and attaching his own name to this law

Lenard was considered an experimentalist of genius and his extensive research included studies on the electrical conductivity of flames and phosphorescence, minimum energy requirement for ionization of gases, composition of atoms by what he termed "dynamids". In the course of his work he invented a photoelectric cell which was the first model of the 3-electrode lamp.

He received honorary doctorates of the universities of Christiania (now Oslo) in 1911, Dresden in 1922 and Pressburg in 1942. He was awarded the Franklin Medal in 1905, the Eagle Shield of the German Reich in 1933 and elected Freeman of Heidelberg in the same year. He became a convinced member of Hitler's National Socialist Party and was made the Chief of Aryan or German Physics.

Chemistry

In recognition of his services in the advancement of organic chemistry and the chemical industry, through his work on organic dyes and hydroaromatic compounds.

Von Baeyer, Johann Friedrich Wilhelm Adolf, b.—October 31, 1835, Berlin, d.—August 20, 1917, Starnberg, near Munich. An organic chemist who synthesized indigo and formulated its structure. Notable among his many achievements were the discovery of the phthalein dyes and his investigations of uric acid derivatives, polyacetylenes, and oxonium salts. He proposed a "strain" theory concerning the conformation of certain cyclic organic compounds, as well as a centric formula for benzene.

VON BAEYER, JOHANN FRIEDRICH
WILHELM ADOLF
Germany

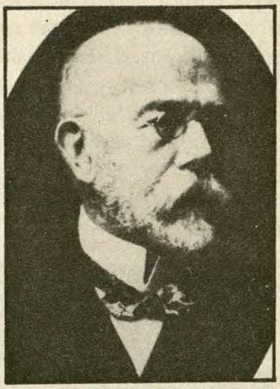
Baeyer studied with Robert Bunsen at Heidelberg. August Kekulé of Bonn exercised a marked influence on his future development. He took his Ph.D. at Berlin (1858), became a lecturer in 1860, and headed the chemistry laboratory at the Berlin *Gewerbeinstitut* until 1872. After holding a professorship at Strasbourg, he succeeded Justus von Liebig as professor of chemistry at Munich (1875), where he continued his research. In 1881, the Royal Society of London awarded him the Davy medal for his work with indigo.

Physiology or Medicine

For his investigations and discoveries in relation to tuberculosis.

Koch, Robert, b.—December 11, 1843, Klausthal, Prussia, d.—May 27, 1910, Baden Baden. Koch was the third of thirteen children. His father, a mining official, created an undying desire for travel in him. From his mother he learnt to love and respect nature, and this interest shaped his subsequent career. He graduated in medicine from the University of Göttingen in 1866 and became a field surgeon in the German army in the Franco-Prussian war (1870-71).

Bacteriology was not then being taught in medical faculties, but Louis Pasteur's discoveries were provoking a lot of interest and discussion. After graduation, Koch practised successfully as a doctor, eventually establishing a surgery in Wollstein. The research that was destined to change medical science began here in a small laboratory that he equipped himself.



KOCH, ROBERT
Germany

Koch's research centred on anthrax, a disease which caused the death of a number of sheep and cattle every year. The cause of this disease was earlier shown to be probably due to the presence of microscopic, rod-like organisms. It was still not known why this disease appeared all of a sudden and that too seasonally. Koch studied cultures of these organisms under the microscope and discovered that the anthrax bacillus formed spores which could remain dormant in unused pastures for several years and then infect unlucky grazing stock. His experiments involved the infection of mice, both with the blood of anthrax-diseased sheep and with a pure culture of the bacterium. The infection was passed from mice to mice several times. Thus he could clearly demonstrate the presence of rod-like organisms in the blood of infected mice. During the course of these experiments he discovered other micro-organisms which resembled but were not identical to those causing anthrax. These, he found, induced a different disease.

"Koch's Postulates", as they became known, stated that the organism had to be present in every case of the disease, that it could be cultured for several generations, and that, when introduced into a healthy subject, the organism should induce the same disease. His work established the parasitic theory of infection. Koch's postulates form the basis of many, though not all, bacterial diagnosis.

Koch's growing reputation secured him a post in the German Health Office. He established a laboratory in Berlin and with the help of his wife and daughter pioneered many techniques including culturing methods and using steam to sterilize equipments. It was in this laboratory that he isolated the tuberculosis bacterium—*Mycobacterium tuberculosis.*

He visited many countries on invitation to tackle crippling diseases endemic to these places. He discovered the cause of amoebic dysentry in Egypt. In India, Koch established the cause of cholera as a bacteria—*Vibrio comma,* and also the transmission and sources of the disease. He isolated *Trypanosoma gambiense,* the organism responsible for sleeping sickness and also those responsible for African relapsing fever and rinderpest. His dedication to the elimination of these devastating diseases gained him the prize.

Literature

Because of his outstanding merits as an epic writer.

Sienkiewicz, Henryk, pseudonym *Litwos*, b.—May 5, 1846, Wola Okrzejska, Poland, d.—November 15, 1916, Verey, Switzerland. An author of novels filled with action and colour which gained him great popularity. After schooling in Warsaw, he studied literature, history and philology at the Warsaw University but left the studies in 1871 without taking a degree.

He began to publish critical articles in 1869 showing the influence of Positivism, a system of philosophy popular in Poland and elsewhere during the period. His first novel *Na Darno* (In Vain) appeared in 1872, and his first story, *Stray sluga* (An Old Retainer) in 1875. He travelled in USA during 1876-78 as the special correspondent of the *Gazeta Polska* (Polish Gazette) and after return to Poland published successful short stories like *Yanko Muzykant* (Yanko the Musician, 1879), *Latarnik* (The Lighthouse Keeper, 1882); and *Bartek Swyciezca* (Bartek the Conqueror, 1882). From 1882 to 1887 he was the co-editor of the daily *Stowo.* In 1900, he was presented with a small estate by the Polish people where he lived until 1914.

SIENKIEWICZ, HENRYK
Poland

During World War I, he promoted the cause of Polish Independence and organized relief for Polish victims of War. His great historical triology began to appear in *Stowo* from 1883. It was written to fortify the minds of his suffering countrymen. The triology is composed of *Ogniem I meiczem* (1884, With Fire and Sword, 1890), *Potop* (1886; The Deluge, 1891) and *Pan Woeodyjowski* (1887-88; Pan Michael, 1893). Set in the later 17th century, it describes Poland's struggles against Cossacks, Tartars, Swedes and the Turks. Although the book is deplored by critical historians for inaccuracies, the literary critics praise it for the narrative character and the revival of Polish language through it.

His other novels include *Bez dogmatu* (Without Dogma, 1890) and the widely translated *Quo Vadis?* (1896), a historical novel on Rome under Nero, followed by *Krzyzacy* (The Knights of the Cross, 1901) and *Na polu Chwaly* (On the Field of Glory, 1906).

Peace

Von Suttner, Baroness, **Bertha Sophie Felicita,** née Countess **Kinsky von Chinic** und **Tettau,** b.—June 9, 1843, Prague, d.—June 21, 1914, Vienna. A novelist and one of the first notable woman pacifists who is credited with influencing Alfred Nobel in the establishment of the Nobel Prize for Peace. Her major novel was *Die Waffen nieder* (1889, Lay Down Your Arms).

The daughter of an impoverished Austrian field marshal, Graf Franz Josef von Kinsky, she was a governess to the wealthy von Suttner family. She became engaged to Baron Arthur Gundaccar von Suttner, an engineer and novelist, seven years her junior. The opposition of his family to this match caused her to answer Nobel's advertisement for a secretary and housekeeper at his Paris residence. After only a week, she returned to Vienna and secretly married Baron Suttner. They lived at Tiflis (Tbilisi, now in USSR) until the Suttner family finally decided to accept their marriage.

VON SUTTNER, Baroness, BERTHA SOPHIE FELICITA, nee Countess KINSKY von CHINIC und TETTAU
Austria

Though she saw Nobel only twice, she corresponded with him until his death. Their last meeting followed a peace congress in Berne in which she had taken an active part. It is believed that her increasing identification with the peace movement resulted in an Austrian pacifist organization. Her letters on peace to Nobel induced him to institute a peace prize among the awards for which he provided in his will.

Bertha von Suttner edited the international pacifist journal *Die Waffen nieder,* named after her most famous novel. Her pacifism had a scientific and free thinking basis, reflecting the thoughts of Buckle, Spencer, and Darwin; it lacked a working class bias and was intended to convince the upper middle class.

1906

PHYSICS

Thomson, Sir Joseph John

CHEMISTRY

Moissan, Ferdinand Frederic Henri

PHYSIOLOGY OR MEDICINE

Golgi, Camillo / Ramon Y. Cajal, Santiago

LITERATURE

Carducci, Giosue

PEACE

Roosevelt, Theodore

1906

Physics

In recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases.

Thomson, Sir Joseph John, b.—December 18, 1856, Manchester, England; d.—August 30, 1940, Cambridge; Elder son of Joseph James Johnson, publisher and bookseller, and Emma Swindells. Thomson entered Owen's College at the age of fourteen intending to take up engineering but could not afford the premium due to his father's death. In 1876 he won a scholarship at Trinity College, Cambridge, where he studied mathematics and was Second Wrangler and Second Smith's Prizeman, and became a Fellow in 1880. In 1882, Thomson was appointed lecturer in mathematics and in 1884 succeeded Lord Rayleigh as Cavendish professor of experimental physics at Cambridge—a post he held until 1919. In 1893 he married Rose Elizabeth, daughter of Sir George Edward Paget; they had a son (George Paget Thomson, who won the Nobel Prize for Physics in 1937), and a daughter.

J.J., as he was known, was a brilliant teacher and had under his guidance some of the finest young minds of the day. Under his leadership, the Cavendish Laboratory became the leading research school in experimental physics. Seven of those who worked under him went on to receive the Nobel Prize. From the day he entered Trinity College, J.J. never missed a term—teaching elementary classes in the mornings and postgraduate classes in the afternoons. Thomson was knighted in 1908, elected FRS in 1908, President of Royal Society from 1915 to 1920, presented the order of Merit in 1912, and appointed Master of Trinity College by the Crown in 1918. Despite his busy working schedule he took interest in politics, sports and a wide range of books. He resigned his Cavendish Professorship after the World War but the University appointed him to a honorary chair which enabled him to continue his work in the laboratory. Thomson died in the Master's Lodge of Trinity on August 30, 1940 and his ashes were buried in Westminster Abbey.

THOMSON, Sir JOSEPH JOHN
Great Britain

The discovery of X-rays had led to increased interest in cathode rays which produce them. Thomson's interest in these rays were the starting point of his discovery of electrons. He reasoned that unlike X-rays and light, cathode rays were not electro-magnetic in origin and began a series of experiments to determine its nature. His experiments involved passing cathode rays through electric fields of known strength and measuring the resulting deflection of the rays. As a result of his experiments, Thomson declared in 1897, that cathode rays were streams of negatively charged particles which he named "corpuscles" and were later to be called electrons. By measuring the ratio of their electric charge and mass, he showed that electrons were subatom in size and therefore might well be actual components of atoms. Thomson suggested that an atom was a sphere of positive electricity containing numerous electrons in its interior just sufficient quantity. His model to neutralize the positive charge resembled a cookie with chocolate chips studded on a mass of dough. Thomson's theory was confirmed by the discovery of "canal rays" by the German chemist Eugen Goldstein.

Though his model was soon replaced by the more accurate solar system model formulated by Ernest Rutherford, Thomson's was the first modern effort to represent atoms in terms of positive and negative electricity and was the forerunner of many complex mathematical theories of the present day.

Chemistry

In recognition of the great services rendered by him in his investigation and isolation of the element fluorine, and for the adoption in the service of science of the electric furnace called after him.

Moissan, Ferdinand Frederic Henri, b.—September 28, 1852, Paris, d.—February 20, 1907, Paris. Received the prize for the isolation of fluorine and the development of the Moissan electric furnace. After attending the *Museum d' Histoire Naturelle* and the *Ecolé de Pharmacié* in Paris, he became professor of toxicology and inorganic chemistry at the *Ecolé de Pharmacié , Paris,* and professor of inorganic chemistry at the Sorbonne. He took up the study of fluorine compounds in 1884. Two years later he succeeded in electrolyzing a solution of potassium fluorine gas. He made a full study of the properties of the element and its reactions with other elements.

MOISSAN, FERDINAND FREDERIC HENRI
France

In 1892, Moissan developed the electric arc furnace and used it to prepare numerous new compounds and to vaporize substances previously regarded as infusible. He discovered silicon carbide and devised a commercially profitable method of producing acetylene. Although he claimed to have synthesized diamonds in his furnace, his success is however doubted by many.

Moissan's scientific works include *Le Four electrique* (1897, The Electric Furnace), *Le Fluor et ses composes* (1900, Fluorine and Its Compounds), and *Traite de chimie minerale* (1904-06, Treatise on Inorganic Chemistry).

Physiology or Medicine

In recognition of their work on the structure of the nervous system.

Golgi, Camillo, b.—July 7, 1843, Corteno, Italy, d.—January 21, 1926, Pavia. Golgi graduated in medicine at Pavia and was a physician in a Pavia hospital for seven years. Later he became the chief physician in the hospital of the small town of Abbiategrasso In 1875 he was appointed Professor of Histology at Pavia, but in the same year he went to Siena as Professor of Anatomy. In 1886 he returned to Pavia as Professor of Histology, and in 1881 was appointed the Head of the Department of General Pathology there.

As a physician at the home for incurables, Abbiategrasso, Italy (1872-75), with only rudimentary facilities at his disposal, he discovered in 1873 the silver nitrate method of staining nerve tissue, an invaluable tool in studies on nerves even today. This stain enabled him to demonstrate the existence in the central nervous system of a particular kind of nerve cell (which came to be known as the Golgi Cell), possessing many short, branching extensions and serving to connect several other nerve cells. Discovery of Golgi Cells led the German anatomist Wilhelm Von Waldeyer to postulate (and Ramon Y. Cajal to establish) that the nerve cell is the basic structural unit of the nervous system, a critical point in the development of modern neurology.

In 1880, Golgi discovered and also described the point at which sensory nerve fibres end in rich branching encapsulated within a tendon, which is now known as the Golgi tendon spindle or Golgi tendon organ. These researches were published in 1885 in his book on the histology of the nervous system. In 1883 he discovered the presence in nerve cells of an irregular network of fibrils, vesicles and granules, now known as the Golgi complex or Golgi apparatus. The Golgi complex, which is found in all cells except in Bacteria, may play an important role in membrane construction, protein and lipid storage and particle transport across the cell membrane.

GOLGI, CAMILLO
Italy

Turning to the study of malaria (1885-93) Golgi found that the two types of intermittent malarial fevers, tertian and quartan, are caused by different species of the protozoan parasite *Plasmodium* and that the paroxysms of fever coincide with the release of the parasites' spores from red blood cells into the blood stream. In 1892 he showed that, while in intermittent types of malaria (tertian and quartan fever) the parasite passes through its life cycle in blood, in the pernicious type of malaria the parasites develop mainly in the organs of the body, especially in the brain.

Golgi's work on the nervous system inspired Ramon Y. Cajal and they were jointly awarded the Nobel Prize in 1906. ◆

In recognition of their work on the structure of the nervous system.

Ramon Y. Cajal, Santiago, b.—May 1, 1852, Petilla de Aragon, Spain, d.—October 17, 1934, Madrid. Ramon Y. Cajal was the son of a country doctor who later became Professor of Anatomy at Zaragoza. In 1873 he was licenced to practise and then served in the Army in Cuba. He graduated as a doctor of medicine at Madrid in 1877. He was Professor of Anatomy at Valencia, of Normal and Pathological Histology at Barcelona, and of both these subjects at Madrid during 1892-1922. In 1900, he was also the Director of the newly founded *Instituto Nacional de Higiene* at Madrid. In 1894 he delivered the Croonian Lecture to the Royal Society, of which he was elected a foreign member in 1909.

Cajal established that the neuron or nerve cell was the basic unit of nervous structure. This finding was fundamental in the recognition and interpretation of nervous function. When Cajal was appointed to Barcelona he worked intensively on the histology of the grey matter, and he improved Golgi's silver impregnation method of staining nervous tissue by developing a gold stain for determination of the fine structure of the nervous tissue of the brain, sensory organs and spinal cord of young animals. His staining method proved very useful for the cytological diagnosis of brain tumours. He disproved the then prevalent theory that the grey matter is a network of anastomosing nerve fibres, and put forward the theory that fibres that appeared to join nerve cells ended in terminal buttons, which, however closely they might approach the nerve cells, never actually touched them. He also discovered the collateral branches of the axon. Cajal postulated that the

RAMON Y. CAJAL, SANTIAGO
Spain

conduction of a nerve impulse is in one direction. He proved the existence of uncrossed fibres in the apparent complete crossing of the optic tracts at the base of the brain. He also proved that the proximal cut end of a nerve grows out to meet the degenerated distal end. Cajal was able to distinguish three types of cells in the neuroglia, the supporting tissue of the nerve fibres in the central nervous system. He also studied vision in the faceted eyes of insects.

He received honorary degrees from many universities, including Oxford and Cambridge. In 1920, the King of Spain commissioned the construction of the Institute Cajal in Madrid to perpetuate his name and to promote researches on the ultrastructure of the nervous system. He worked there in peace until his death.

Cajal's publications include *Estudies sobre de degeneracion y regeneracion del system nervioso* (1913-14), and *The degeneration and regeneration of the nervous system* (1928).

Note: The 1906 prize was awarded jointly to Golgi and Cajal.

Literature

Not only in consideration of his deep learning and critical research, but above all as a tribute to the creative energy, freshness of style, and lyrical force which characterize his poetic masterpieces.

Carducci, Giosue, b.—July 27, 1835, Val di Castello near Lucca, Italy, d.—February 16, 1907, Bologna. A poet and one of the most influential figures in Italy during his time. He was the son of a country doctor and spent his childhood in the wild Maremma in Tosca. He studied at the University of Pisa, where he got his Doctor's degree in 1855, and in 1860 became a professor of Italian language in Bologna where he lectured for over 40 years. He was a senator of Italy and was respected by the Italians as one of their national poets.

In his youth Carducci was the centre of a group of angry youngmen who were determined to overthrow Romanticism and to revive the Classical models. At the age of fourteen Carducci tried his hand at an epic poem in eight-line stanza on the capture of Bolgheri by King Ladislas of Naples, a series of three-line stanzas on the death of Julius Caesar, a translation of Book IX of the *Iliad,* some verse epigrams and two sonnets *A mia madre* (To my mother) and *La Vita* (Life).

CARDUCCI, GIOSUE
Italy

Giuseppe Parini, Vincenzo Monti and Ugo Foscolo were his mentors and their influence is evident in his first book of poems *Rime* (1857); later collected in *Juvenilia* (1880) and *Levia gravia* (Light and Heavy, 1868). He showed his great power as a poet and the strength of his republican anti-clerical feeling in his hymn to Satan, *Inno a Satana* (1863) and in the *Giambi et Epodi* (1876-79) Its violent and bitter language sometimes shows the influence of Victor Hugo and Heinrich Heine and reflects his virile and rebellious character. The *Rima nuove* (1877) and the *Odi barbare* which appeared in the 1880s contain the best of his poetry. The evocations of the Maremma landscape and the memories of childhood are found in *Idillio Maremmano, Davanti San Guido* and *San Martino.* His lamentations for the death of his only son is found in *Funere mersit acerbo* and *Pianto antico.* He represented great historical events in *Caira, Sui campi di Marengo, Comune rustico* and *Canzone di Legnano.* He glorified the Roman history through *Davanti alle Terme di Caracalla, Nell annuale della fondazione di Roma* and *Alle fonti del Clitumno.* His fondness for classical art induced him to adopt Latin prosody in contemporary Italian verse; the *Odi barbare* is written in meters imitative of Horace and Virgil. He reverted to traditional Italian meters in his last book *Rime e* *ritmi* (Rhyme and Rhythm, 1899). His scholarly studies were marred by rhetorical tirades and displays of erudition. His research on Italian literature was enhanced by his poetic imagination and style; his best works in prose also equals his poetry.

Peace

ROOSEVELT, THEODORE
USA

Roosevelt, Theodore, (1858-1919). The Nobel Peace Prize awarded to him added a new dimension to the principles governing this prize. The 1906 prize was not awarded for continuous work in the service of peace, but as a mark of esteem for what might be called "technical" conciliation, resulting in the peace treaty signed at Portsmouth (USA) in 1905 between Russia and Japan.

His conception of the peace problem was determined by a definitely imperialistic philosophy which he expounded in his book, *The Strenuous Life* (1902). With his imperialistic outlook he had, during his period of office as Assistant Secretary for the US Navy from 1897 to 1898, done all in his power to increase the naval strength of his country His constant concern was that the Americans, since the time of the War between the States, had asserted their fighting spirit solely in the economic field.

Roosevelt served in the war against Spain as a colonel in a volunteer cavalry unit called "The Rough Riders". In 1900, he was elected Vice-President under McKinley, and when McKinley was assassinated, he became the President of the USA.

1907

PHYSICS
Michelson, Albert Abraham

CHEMISTRY
Buchner, Eduard

PHYSIOLOGY OR MEDICINE
Laveran, Charles Louis Alphonse

LITERATURE
Kipling, Rudyard

PEACE
Moneta, Ernesto Teodoro / Renault, Louis

1907

Physics

For his optical precision instruments and the spectroscopic and meteorological investigations carried out with their aid.

Michelson, Albert Abraham, b.—December 19, 1852, Strelno, Prussia (now Strzelno, Poland), d.—May 9, 1931, Pasadena, California. When Michelson was barely two, his family left Strelno and emigrated to the United States. They settled in Nevada where his father set up a successful business. At seventeen he entered the United States Naval Academy where he proved to be brilliant in mathematics and science. After graduation in 1873, he remained at the Academy to lecture in science from 1875 to 1879. During this time he developed his fascination with the measurement of velocity of light. He left the Academy to study the latest theories of optics and travelled widely in Europe, especially France and Germany, for two years and returned to the United States to begin his experiments. In 1883, he became professor of physics at the Case School of Applied Science in Cleveland, Ohio. In 1892, he became the head of the Physics Department at the University of Chicago.

In 1882, Michelson measured the velocity of light as 186,320 miles per second—this remained the best estimate for fifty years, even then the credit for improving on it goes to Michelson himself. He built an instrument called the interferometer which split a light beam into two, sent them on two separate paths, and then brought them together again. His theory was that if the parts of the beam travelled different distances at the same velocity, or the same distance at different velocities, they would be out of phase with each other when recombined which would produce a series of light and dark bands called an interference pattern. It was believed then that all space was filled by "ether" and light was a vibration in the "ether". Michelson decided to use his instrument to measure the velocity of earth. He conjectured that if he sent one part of a light beam in the direction of the earth's motion and the other at right angles to the earth's motion, one would have greater velocity than the other. After travelling the same time, on recombination, the degree to which the beams were out of phase will show on the interference pattern, which in turn would provide a measure of the velocity of the earth through ether. Michelson's first experiments showed no interference pattern. After repeated failures, he conducted the experiment again in 1887 with the help of his friend and colleague Edward Morley. This time he took careful precautions to avoid experimental error. Again, there was no interference pattern and Michelson, thinking his apparatus was inadequate, abandoned his experiments. Scientists however realized that the absence of an interference pattern could be because there was no ether. This only created further speculations on the nature of light

MICHELSON, ALBERT ABRAHAM
USA

and space and culminated in Einstein's theory of relativity. Michelson returned to his obsession of measuring the velocity of light and began work with more accurate methods of measurement. With an interferometer he accurately measured the diameter of a star. His health failed and he died without carrying out his pet experiment. It was left to his assistants to complete his work and, in 1933, the velocity of light was announced to be 1,86,271 miles per second—just 11 miles less than the best estimates available today. Albert Einstein acknowledged his debt to Michelson whose experiment influenced his special theory of relativity.

Chemistry

For his biochemical researches and his discovery of cell-free fermentation.

Buchner, Eduard, b.—May 20, 1860, Munich; d.—August, 13, 1917, Romania. He worked as a chemist for a few years in a sweet factory before he joined the University of Munich to study under J.F.W.A. von Baeyer (Nobel Laureate) and T.C. Curtius. Buchner received his doctorate in 1888, and served as Baeyer's assistant for five years. He became Privat-Dozent in Kiel (1893), Assistant Professor in Tübingen (1896) and then Professor in the *Landwirtschaftliche Hochschule* in Berlin (1898), briefly at Breslau, and finally at Würzburg (1911). Despite lack of encouragement he persisted in his researches with fermentation and made notable advances during 1896 and 1897. As a reserve officer he was called to the Army in August 1914, but returned to Würzburg in 1916 He was killed while serving as a major in the German army during World War I.

Buchner's work on fermentation, partly in collaboration with his elder brother Hans, is of great significance. He was able to prepare a cell-free extract that would ferment sucrose to ethanol, by grinding yeast cells with sand at a controlled temperature. He ascribed the fermentation of sucrose to ethanol to an hypothetical enzyme 'zymase' which was later shown to be very complex by A. Harden (Nobel Laureate). He demonstrated that the active cause of alcoholic fermentation is the action of different enzymes contained in yeast. He showed that zymase can be extracted from yeast cells and that it causes sugar to break up into carbon-dioxide and alcohol.

BUCHNER, EDUARD
Germany

Buchner showed that living yeast cells were not essential for fermentation as was supposed by Pasteur and others. His work marked the beginning of modern enzyme chemistry. For this remarkable work he was awarded the Nobel Prize for chemistry in 1907.

Physiology or Medicine

In recognition of his work on the role played by protozoa in causing diseases.

Laveran, Charles Louis Alphonse, b.—June 18, 1845, Paris, d.—May 18, 1922, Paris. A physician, pathologist, and parasitologist who in 1880 discovered in Algeria the parasite that causes human malaria.

Educated at the Strassbourg School of Medicine, he served as an army surgeon in the Franco-German War and practised and taught military medicine until 1897 when he joined the Pasteur Institute, where he worked until his death.

Laveran was a powerful influence in developing research in tropical medicine, carrying on fruitful work in *trypanosomiasis, leishmaniasis*, and other protozoal diseases, as well as his unique work on malaria. He established the Laboratory of Tropical Diseases at the Pasteur Institute (1907) and founded the *Societé de Pathologié Exotique* In addition to receiving the Nobel Prize, he was elected to the Academy of Medicine and Academy of Sciences and became commander of the Legion of Honour.

LAVERAN, CHARLES LOUIS ALPHONSE
France

The scientific papers and textbooks originating from his research on trypanosomiasis, leishmaniasis, and other protozoal diseases include *Trypanosomes et trypanosomiasis* (1904), with Felix Masnil; the famous publication on malaria, *Traite des fievres palustres avec la description des maladies et epidemies des armees* (1875); *Traite d' hygiene militaire* (1876), and *Traite du paludisme* (1897).

Literature

In consideration of the power of observation, originality of imagination; virility of ideas and remarkable talent for narration which characterize the creations of this world-famous author

Kipling, Rudyard, b.—December 30, 1865, Bombay, India, d.—January 18, 1936, London. A British novelist, short story writer and poet who is remembered for his anecdotes and poems on the British soldiers working in India and Burma and his stories and tales for children. His father was the Director of the Bombay School of Art. Kipling stayed in India till the age of six and learnt many Indian folktales from domestic servants which were later reflected in his books for children. His childhood was rather unhappy

He graduated from the Westward Ho College in 1876, and came back to India in 1882. He was appointed on the editorial staff of the *Civil and Military Gazette* of Lahore, later he joined as the Editor of the *Pioneer,* a daily published from Allahabad, India.

His famous children's classics include *Departmental Ditties* (1886), *The Light that Failed* (1891), *The Jungle Books* (1894-95), *Stalky and Co.* (1899), *Kim* (1901) and *Puck of Pook's Hill* (1906). He made the sarcastic utterance *East is East and West is West and never the twain shall meet.*

In 1917, he became a member of the War Graves Commission and met the King and Queen of England. In 1895, he refused an offer to become Poet Laureate and in 1899, refused the offer of a title.

KIPLING, RUDYARD
Great Britain

He received honorary degrees from the universities of McGill, Durham, Oxford, Cambridge, Edinburgh, Strasbourg and Paris. In 1926, he received the Gold Medal of the Royal Society of Literature. He even became the member of the French Academy of Moral and Political Sciences. The Kipling Society was started in 1927

Peace

Moneta, Ernesto Teodoro, b.—September 20, 1833, Milan, d.—February 10, 1918, Milan. An Italian journalist and pacifist who bore all the marks of a struggle for national independence.

He obtained his far-reaching impressions on war while he fought on the barricades in Milan during the Milanese insurrection of 1848. His father joined in the fighting.

MONETA, ERNESTO TEODORO
Italy

During the years prior to the war of liberation of 1859-61, he was the leader of a secret society which maintained contact with the Italian patriot-hero Pallavicino. In 1859, he fought under Garibaldi in North Italy, and in the following year at Volturno in Calabria. Later he was an officer in the Italian army, but after the defeat at Custozza in 1866, he resigned his commission, and devoted himself wholly to publishing. In 1867 Moneta became editor of *Il Secolo,* which under his leadership became one of the most widely read newspapers in Italy. Moneta was no believer in the principle of nonviolence in the face of aggression. He saw no incompatibility between defending the right of a nation to self-government and the work of promoting international understanding. In this respect he was in agreement with the leaders of the Italian national movement, Mazzini and Garibaldi. Holding pacifist views, Moneta never became a militarist, and after he had taken up active peace work by about 1870, he was to have frequent opportunities of proving that this feeling of international solidarity was the proof against the nationalist sentiment which, at intervals, swept across Italy.

His campaign, directed against the fear of France which flared up after the French occupation of Tunis in 1881, was very important. Through the columns of *Il Secolo,* through popular pamphlets and the periodical *Vita Internazionale* (International life) and through his leadership of the peace league *Sociata internazionale per la peace : Union Lombarda,* (International Society for Peace : Lombard League), which he founded in 1887, he worked to calm strained tempers between neighbouring nations of Europe.

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Renault, Louis, b.—May 21, 1843, Autun, France, d.—February 8, 1918, Barbizion, France. From 1882 on he was professor of international law in Paris and from 1890 a consultant to the French Foreign Office. He was elected delegate at all the legal conferences at which the French Government was represented. With Tobias Asser, he was largely responsible for the positive results achieved at the conference of Private International Law at The Hague. He was also responsible for the revised Red Cross Convention of 1906.

RENAULT, LOUIS
France

Renault was an ardent advocate of the idea of arbitration, and he acted personally in the capacity of judge. His reputation for impartiality was firmly established during the so-called Savarkar trial. Vinayak Damodar Savarkar, an Indian nationalist studying law in England, was being transported to India after arrest by the British. He jumped overboard and alighted on the coast of France and was rearrested. He sought asylum from the French Government. The resultant legal dispute was handled by Renault. Both England and France requested the services of Renault as a judge. Renault was unable to share the disappointment felt at the fact that not all cases for arbitration were brought before the Permanent Arbitration Court at The Hague, which had been established by the Peace Conference of 1899.

Note: The 1907 prize was divided equally between Moneta and Renault.

1908

PHYSICS

Lippmann, Gabriel

CHEMISTRY

Rutherford, Lord Ernest

PHYSIOLOGY OR MEDICINE

Ehrlich, Paul/Mecnikov, Il'Ja Il'Jic

LITERATURE

Eucken, Rudolph Christoph

PEACE

Arnoldson, Klas Pontus/Bajer, Fredrik

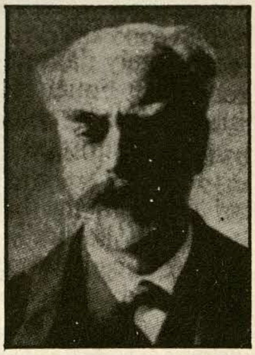
1908

Physics

For his method of reproducing colours photographically based on the phenomenon of interference.

Lippmann, Gabriel, b.—August 16, 1845, Hollrich, Luxemburg, France, d.—July 13, 1921, at sea. When 23, he entered *École Normale* and although he showed promise and ingenuity in his experiments, Lippmann failed his examination. Subsequently he was sent to Germany to do research and to report on German laboratories. In Heidelberg he worked with G.R. Kirchhoff and began research on electrocapillarity which he continued on his return to Paris in 1875. In Paris he conducted his research first at *École Normale* and then at Sorbonne where he was appointed professor of probability and mathematical physics in 1883. As a consequence of his researches, in 1873, he invented the capillary electrometer, a highly sensitive instrument used for measuring extremely small voltages. It was used in some of the earliest electrocardiograph machines. In 1886, he was elected a member of *Academie des Sciences,* and the same year became Director of Laboratories of Physical Research and succeeded J.C. Jamin as professor of physics at the Sorbonne where he worked until his death. His first reference to processing colour photography seems to have been expressed during his lectures in 1886. He believed that light reflected from a flat plate would produce interference planes at characteristic distances from the surface depending on the frequency. This, according to Lord Rayleigh, who advanced the same theory in 1887, was possibly the coloured spectrum observed by Edmond Becquerel in 1848.

The practical development of Lippmann's idea was however taught with difficulties. The film was to be made from material having silver granules of size smaller than the wave length of light and an optical contact was required between the film and the reflecting surface. In 1893, he succeeded in producing a perfectly orthochromatic colour photograph, by placing a reflecting coat of mercury behind the emulsion on the photographic plate. Though this was the only direct method of colour photography at that time, it was not practical because of the long exposure time necessary and because copies could not be made from the original plate.



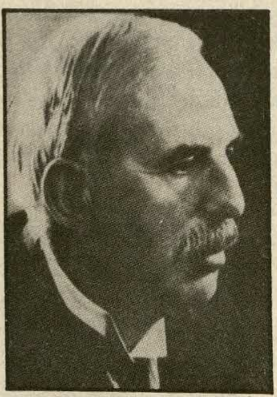
LIPPMANN, GABRIEL
France

Lippmann was devoted to the precise measurement of various units and constructed a number of important instruments including a perfectly astatic galvanometer, a seismograph and the coelostat which enabled scientists for the first time to keep the sky under observation for an extended period of time. In 1908 he was elected foreign member of the Royal Society.

Chemistry

For his investigations into the disintegration of the elements, and the chemistry of radioactive substances.

Rutherford, Lord Ernest, b.—August 30, 1871, Spring Grove, New Zealand, d.—October 19, 1937, Cambridge. Rutherford was the second son of James Rutherford, a tough, practical man, a wheelwright by trade, who successfully turned to farming. He shared his father's pleasure of hard work in the open, and often helped with the running of the farm, but he also showed great promise as a student and won a scholarship to Canterbury College in 1889 in Christchurch, from where he graduated with honours. Three years later he won a scholarship to Cambridge University in England.



RUTHERFORD, Lord ERNEST
Great Britain

At Cambridge University he worked under Sir J.J. Thomson (Nobel Laureate), who in 1897 proved the existence of the electron, whilst in 1895 Röntgen (Nobel Laureate) had found X-rays and in 1896 Becquerel (Nobel Laureate) had found that uranium compounds emit radiation similar to X-rays. For Rutherford it was the beginning of a lifelong interest in radioactivity and atomic structure. He began a series of experiments analysing the radiation emitted by elements such as uranium, and discovered that such radiation consisted of three components. Two of these were made up of beams of tiny particles that he called alpha and beta rays. The third component was a high-frequency electromagnetic radiation that he named gamma rays. This research was described in five papers, which were published before Rutherford left Cambridge in 1898.

The same year, at the age of twentysix, he was appointed to the Macdonald Research Professorship of Physics at McGill University, Montreal. He studied the radioactivity of thorium. Eventually, in 1903, he and F. Soddy put forward the theory of successive transformations. They showed that elements such as uranium and thorium are spontaneously transmuted into other intermediate elements during radioactive decay. Further, each intermediate element itself breaks down at a fixed rate so that half of a given quantity of it decays within a certain period of time. Rutherford called this period the "half-life" of the element. This theory, which completely contradicted the accepted view that matter is indestructible, was at first received with scepticism, but the theory was generally accepted by 1907. In 1903 Rutherford was elected Fellow of Royal Society. His classic book *Radioactivity* (1904) won him worldwide recognition.

In 1907, he was appointed Langworthy Professor of Physics at Manchester and worked on the nature of alpha particles, until in 1908 he proved the alpha particles to be helium.

Rutherford maintained a high level of activity. At one stage in a period of seven years he published over 80 scientific papers. Most important of these were investigations of alpha and beta radiation, work that led him directly to his greatest contribution to science, the nuclear model of the atom.

Rutherford was an outstanding team leader. In the course of the study of alpha-rays, H. Geiger and E. Marsden in Rutherford's laboratory found that one ray in about 8,000 striking a piece of platinum was deflected through more than a right angle. Rutherford was amazed by this, and was able to show that collisions with electrons were quite unable to turn even this small fraction. He inferred that there must be something in an atom that is heavy, small, and has a large electric charge. On this basis Rutherford erected his nuclear theory of the atom which was confirmed fully by experiments on different metals. Modification of this experiment by Niels Bohr with expertise rendered by Rutherford showed how the electron might perform orbits round the nucleus, determined by the quantum theory, like planets round the sun. In 1911, in a paper in the *Philosophical Magazine,* he propounded the nuclear theory of the atom.

In 1914, he visited the USA, Australia and New Zealand, lecturing on his discoveries. Between 1915-17 he was engaged in Admiralty work connected with anti-submarine warfare. In 1919, working alone in his Manchester laboratory, he provided evidence of the artificial transmutation of matter and published his findings in the *Philosophical Magazine.*

In 1919, he succeeded J.J. Thomson (Nobel Laureate) to the Cavendish Chair of Experimental Physics at Cambridge, where he worked until 1937. During this period, he continued his own researches, discovering that long-range particles from nitrogen are hydrogen nuclei and speculated on the existence of the neutron.

He was awarded the Order of Merit in 1921, elected President of the Royal Society in 1925 and in 1931 became Baron Rutherford of Nelson. During 1930-37, he was Chairman of the Advisory Council of the Department of Scientific and Industrial Research. In 1937 he published *The Newer Alchemy,* an account of the work carried out by his colleagues James Chadwick, John Cockroft and others in the transmutation of elements. Sir Henry Tizard has expressed the view that, 'In the whole course of the history of science no one has surpassed Rutherford in his influence on his contemporaries.'

In 1900, he married Mary Georgina of Christchurch, New Zealand. They had one daughter. Throughout his life, Rutherford's warm and humorous nature won many admirers. He was violently opposed to the rise of Nazis in Germany. During the last years of his life, he helped Jewish refugees to flee from Nazi persecution. He died in Cambridge on October 19, 1937 and was buried in Westminster Abbey.

Physiology or Medicine

In recognition of their work on immunity.

Ehrlich, Paul, b.—March 14, 1854, Streheln, Silesia (now Stryelin in Poland), d.—August 20, 1915, Bad Homburg vor der Wohe, West Germany. The son of a lottery-office keeper, Ehrlich received his early education in his native town and at the Gymnasium at Breslau. He also spent his first university semester at Breslau, studying scientific subjects, and then proceeded to Strasbourg, where he took up the study of medicine. While still an undergraduate he attracted the attention of Waldeyer by his application of aniline dyes in the histology. After graduation he worked for a year in the Pathological Institute under Cohnheim and Heidenhain. In 1877 he was appointed chief assistant in a clinic at Berlin. Ehrlich contracted tuberculosis in 1886, apparently as a result of accidental infection in the course of his researches, and was forced to give up his work for a year and a half, which he spent in travelling abroad. Returning to Berlin, he worked in a small private laboratory, then obtained a post in the Institute for Infectious Diseases, which he held for several years. When the new Serum Institute at Steglitz was opened in 1896, Ehrlich was appointed Director. From 1899 until his death in 1915 he was Director of the Royal Institute for Experimental Therapy in Frankfurt-am-Main. He was raised to the dignity of Privy Councilor with the title "Excellenz" in 1911.

EHRLICH, PAUL
Germany

Ehrlich had been stimulated by reading an account of the way tissues are affected by lead and got interested in the effect of chemicals on the cells of the body. He demonstrated that cells of certain organs most affected during lead poisoning also absorb lead in test-tube solutions. His work impressed the German microbiologist, Robert Koch (Nobel Laureate in Medicine 1905), who offered him a post at his Institute for Infectious Diseases.

On the basis of the discoveries by Emil von Behring, a German physician, that toxins produced by certain bacteria such as tetanus and diphtheria stimulate the cells of the body to produce antitoxins which then neutralized the poison, Ehrlich pioneered the large-scale production of diphtheria antitoxins in horses. In appreciation of this work the German government appointed him as the Director of the Royal Institute for Experimental Therapy in Frankfurt-am-Main.

Further work with antitoxins made Ehrlich realize that they had limited uses and almost no effect against syphilis or diseases caused by protozoans, such as the African sleeping sickness. He considered that if an organic substance such as an antitoxin could have a prophylactic effect, it should be possible to make a synthetic drug with a similar antimicrobial activity, especially if the microbe showed an affinity for that chemical.

Ehrlich had read of the successful use of arsenic compounds against trypanosoma, an organism resembling the syphilis spirochaete, which causes the disease African sleeping sickness. He began looking for a chemical compound, harmless to man, which would destroy the disease causing organism, unlike the arsenic compounds which were known to be generally poisonous to man. He tested a large number of compounds, and discovered the drug arsphenamine which would destroy the syphilis spirochaete, in the year 1910. This drug has eventually come to be known as "Neosalvarsan", under which name it is now being marketed. Thus Ehrlich became the founder of chemotherapy and made a fortune with the sale of his drug. This also helped the German chemical plants to take the lead in the development of the synthetic drugs industry.

Ehrlich received the prize for his work on immunology. His name was nominated seventy times in the short span of eight years by learned men from 13 countries before he could ultimately receive the prize.

◆

In recognition of their work on immunity.

Mecnikov, Il'Ja Il'Jic, b.—May 15, 1845, near Kharkov, in Ukraine, d.—July 16, 1916, Paris. He was the son of an officer of the Russian Imperial Guard. A zoologist and microbiologist who shared with Paul Ehrlich the prize for discovery in animals of amoeba-like cells which engulf foreign bodies such as bacteria. The phenomenon is known as "phagocytosis" and is a fundamental tenet of the science of immunology. A graduate of the Kharkov Gorky State University, he was professor of zoology and comparative anatomy at the University of Odessa. While studying the origin of digestive organs in starfish larvas at Messina, he observed that certain cells, unconnected with digestion, surrounded and engulfed carmine dye particles and splinters which he had introduced into the bodies of the larvae.

MECNIKOV, IL'JA IL'JIC
Russia

He called these cells as *phagocytes* (from Sk. *bhaga*–divide; Gk.*phagus*–a fig). He established the phagocyte as the first line of defense against acute infection in most animals, including man, whose phagocytes are known as leukocytes, or white blood corpuscles. With the French bacteriologist Roux, Mecnikov succeeded in transmitting syphilis to apes. He devoted the last decade of his life to the study of lactic acid-producing bacteria as a means of increasing longevity. He wrote *The Comparative Pathology of Inflammation* (1892), *L'Immunite dans les maladies infectieuses* (1901, Eng. trans., Immunity in Infectious Diseases, 1905) and *Etudes sur la nature humaine* (1903, The Nature of Man, 1904).

Note: The 1908 prize was awarded jointly to Mecnikov and Ehrlich.

Literature

In recognition of his earnest search for truth, his penetrating power of thought, his wide range of vision, and the warmth and strength in presentation with which in his numerous works he has vindicated and developed an idealistic philosophy of life.

Eucken, Rudolph Christoph, b.—January 5, 1846, Aurich, East Friesland, West Germany, d.—September 5, 1926, Jena, East Germany. An idealist philosopher and interpreter of Aristotle and author of several works on ethics and religion.

He studied at the University of Göettingen under the German thinker Lotze who was an idealist. Later he studied at Berlin under Trendelenburg, a philosopher whose ethical concerns and historical treatment of philosophy influenced him. He was appointed a professor of philosophy at the University of Basel, Switzerland, in 1871. He soon abandoned the job and became a professor of philosophy at the University of Jena, a post which he held until 1920. He distrusted abstract intellectualism and systematics and centred his ideas upon actual human experience. He believed that man is the confluence of nature and spirit and it is man's duty and privilege to overcome his non-spiritual nature. His ideas are reflected in his writings like *Geistige Stromungen der Gegenwart* (Main Currents of Modern Thought, 1904), *Der Wahrheitsgehalt der Religion* (The Truth of Religion, 1901), *Individual and Society* (1923) and *Der Sozialismus und seine Lebensgestaltung* (1920; Socialism: An Analysis, 1921). In the last book, he attacked socialism as a system that limits human freedom and denigrated spiritual and cultural aspects of life. His other works include *Der Sinn und Wert des Lebens* (1908; The Meaning and Value of Life, 1909), *Erkennen und Leben* (Knowing and Living, 1912) and *Koennen wir noch Christen sein?* (1911, Can We Still be Christians? 1914). In 1920, an Eucken Society (Euckenbund) was formed to propagate his ideas; its organ was the journal *Die Tatwelt.*

EUCKEN, RUDOLF CHRISTOPH
Germany

Peace

Arnoldson, Klas Pontus, b.—October 27, 1844, Goeteborg, Sweden, d.—February 20, 1916, Stockholm. A politician who figured prominently in solving the problems of the Norwegian-Swedish Union. Arnoldson started his career as a railway clerk and rose to the post of station master. He then left the railway service to devote himself entirely to politics and quest for peace.

ARNOLDSON, KLAS PONTUS
Sweden

In 1881, he was elected to the *Riksdag* (Swedish Parliament). He was a devoted pacifist and supported the neutrality of the Nordic countries. In 1883, he helped to establish the Swedish Association for Peace and conciliation. In 1890, when the conflict between Norway and Sweden was critical, he used all his efforts to arouse public opinion in both countries in favour of a peaceful solution. In 1905, he witnessed the result of his efforts in the mutually agreed dissolution of the union.

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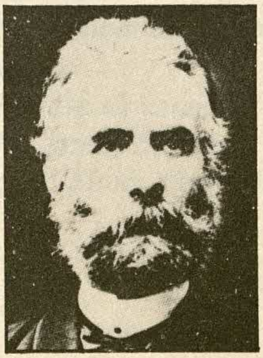


BAJER, FREDRIK
Denmark

Bajer, Fredrik, b.—April, 21, 1837, Denmark, d.—January 22, 1922, Copenhagen. Bajer entered the army but was discharged when it was disbanded after the war with Prussia. He then started working for the emancipation of women, the peace movement, and for Scandinavian cooperation.

He was a founder of the Danish Women's Association and established the Association for the Neutralization of Denmark. He was a left-wing liberal member of the Danish Parliament and advocated international arbitration treaties and considerably influenced the development of the Danish policy of neutrality. He was a prominent delegate to the first Scandinavian peace conference and provided great impetus for the formation of the International Peace Bureau in Bern in 1891 and acted as its president till 1907. He edited the *Folkevennen* (The People's Friend) from 1877 to 1879. He attended 14 world peace congresses and 14 interparliamentary conferences.

Note: The 1908 Peace prize was divided equally between Arnoldson and Bajer.

1909

PHYSICS

Braun, Carl Ferdinand
Marconi, Guglielmo

CHEMISTRY

Ostwald, Wilhelm

PHYSIOLOGY OR MEDICINE

Kocher, Emil Theodor

LITERATURE

Lagerloef, Selma Ottiliana Lovisa

PEACE

D'Estournelles De Constant,
Paul Henri Benjamin Balluet
Beernaert, Auguste Marie Francois

1909

Physics

In recognition of their contributions to the development of wireless telegraph.

Braun, Carl Ferdinand, b.—June 6, 1850, Fulda in Germany; d.—April 20, 1918, New York City. He was educated at the local "Gymnasium" (grammar school) and later studied at the universities of Marburg and Berlin from where he graduated in 1872.

Braun first worked on the oscillation of strings and elastic rods. Other studies included thermodynamic principles and solubility of solids under the influence of pressure. His most important work, however, was in electricity. He published papers on the deviations from Ohm's Law and on the calculations of the electromotive force of reversible galvanic elements from thermal sources. In 1897 he invented the Braun's electrometer.

BRAUN, CARL FERDINAND
Germany

In 1898, he became interested in wireless telegraphy. His first attempt was to transmit Morse-signals through water by high-frequency currents. Later he introduced the closed circuit of oscillation and was one of the first to send electric waves in definite directions. His papers on wireless telegraphy were published in 1901 in the form of a brochure titled *Drahtlose Telegraphie durch Wasser und Luft* (Wireless Telegraphy through Water and Air). He succeeded in receiving definitely directed messages in 1902 by means of an inclined beam antennae. He shared the 1909 prize with Guglielmo Marconi of Italy for the development of wireless telegraphy. Braun modified Marconi's transmitter, greatly increasing the broadcasting range. His subsequent discovery of crystal rectifiers, devices that allow current to flow in one direction only led to further improvements of radio receivers.

After appointments at the universities of Wuerzburg and Marburg, Braun became professor of physics at the University of Tuebingen in 1885, and accepted the directorship and chair of physics at the University of Strasbourg in 1895. He studied cathode rays and invented the oscilloscope in 1897, with which he studied high-frequency currents. This invention was the forerunner of the television tube and radarscope and became an important laboratory instrument of the future.

After the outbreak of World War I Braun was summoned to New York as a witness to a lawsuit on a patent claim. His absence from his laboratory and illness put an end to further scientific work. He spent the last years of his life peacefully in the United States.

◆

In recognition of their contributions to the development of wireless telegraphy.

Marconi, Guglielmo, b.—April 25, 1874, Bologna, Italy, d.—July 20, 1937, Rome. Marconi was the son of a wealthy Italian landowner and an Irish mother. He was educated by private tutors, completing his education at the Leghorn technical school where he developed an interest in physics. He conducted his early experiments on his father's estate near Bologna, and within twelve months, established wireless communication over a distance of more than a mile.

In 1895, he succeeded in transmitting a signal beyond the line of vision, with a hill in between. Since his work was not appreciated by the Italian government, he went to London in 1896. On June 2, 1896, he took out his first patent for wireless telegraphy based on Hertz's discoveries, through exploiting radiations of a much longer wavelength. Encouraged by the interest of the British Post Office, he improved this system to a point where he was able to send wireless signal nine miles across the Bristol Channel. The following year he set up the Wireless Telegraph Company in London with his Irish cousin, for the exploitation of his patents in all countries except Italy. In 1899, Marconi established a wireless station in Southern England for communication with France 31 miles away. The same year, he also equipped two US ships to report to newspapers in New York City the progress of the yacht race for the America Cup; this led to the formation of the American Marconi Company.

MARCONI, GUGLIELMO
Italy

It was thought that radio transmission would be limited to 200 miles at the most because of the curve of the earth's surface. But he disproved it by successful transmission of signal from Poldhu, Cornwall, to St. John's, Newfoundland, 2000 miles away. Marconi could achieve this by replacing the wire receiver with a coherer, a glass tube filled with iron filings, which could conduct radio waves.

Marconi's British patent was given in 1900, for improvements in apparatus for wireless telegraphy which enabled several stations to operate on different wavelengths without interference. In 1902 Marconi patented a magnetic detector, in 1905 the horizontal directional aerial, in 1911 he took over the master patent of Oliver Lodge for a tuning device and in the following year he introduced the "timed spark system" for generating continuous waves. In 1916, he began to experiment with short waves in order to device a beam system for war purposes. The results of these researches helped later in peacetime to transform long distance wireless communication. The Marconi Wireless Telegraph Company, which he founded in Britain, still exists as one of the world's leading electronics manufacturers.

In 1909 Marconi shared the prize with Carl Ferdinand Braun, who made important modifications which increased the range of the first Marconi-transmitters considerably. Marconi's other distinctions include the Knight Grand Cross of the Royal Victorian Order, and an Italian marquisate.

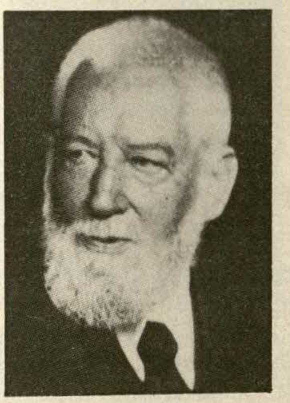
Note: The 1909 prize was awarded jointly to Braun and Marconi.

Chemistry

In recognition of his work on catalysis and for his investigations into the fundamental principles governing chemical equilibria and rates of reaction.

Ostwald, Wilhelm, b.—September 2, 1853, Riga, Latvia, d.—April 4, 1932, near Leipzig, East Germany. A chemist who organized physical chemistry into a nearly independent branch of chemistry and won the prize for his work on catalysis, chemical equilibrium, and reaction velocities. He was strongly philosophical in his approach to science and preferred energy as the explanation for all physical phenomena and refused to believe in atoms.

He took his doctorate from the University of Dorpat in Tartu, Estonia, in 1878 and taught at Riga before going to the University of Leipzig. He was quick to combine the theories of Arrhenius and Van't Hoff, with which he placed physical chemistry on a firm basis. It was probably as author and editor, however, that he helped most to advance the science. He wrote *Lehrbuch der allgemeinen Chemie* (in 2 volumes, 1885-87, *Textbook of General Chemistry* and other Texts) and was chiefly responsible for the founding of the *Zeitschrift fuer physikalische Chemie* (1887, Journal of Physical Chemistry), an influential publication in the field.



OSTWALD, WILHELM
Germany

He began laboratory researches with studies on the dynamics of reactions in solution, and then turned to electrochemistry. In 1894, he gave the first modern definition of a catalyst and turned his attention to catalytic reactions. His process for the conversion of ammonia to nitric acid was patented in 1902 which became a fact of great industrial significance.

Following his resignation from the University of Leipzig, he wrote on the philosophy of science and, in *Grosse Maenner* (1909, Great Men), investigated the psychological causes of scientific productivity. He published a three-volume autobiography. Towards the end of his life, painting, one of his many activities, led him to investigate colour from physical and psychological viewpoints.

Physiology or Medicine

For his work on the physiology, pathology and surgery of the thyroid gland.

Kocher, Emil Theodor, b.—August 25, 1841, Bern, Switzerland, d.—July 27, 1917, Switzerland. Kocher was the son of an engineer. After graduation in Bern, he continued his studies in Berlin, London, Paris and Vienna. He studied under the famous surgeon Theodor Billroth in Vienna. He was appointed Professor of Clinical Surgery at Berne University in 1872, and was head of the University Surgical Centre for forty-five years.

Kocher contributed excessively to techniques of surgical operations; one that deserves special mention is his pioneering of ovariotomy and the application of the antiseptic surgery of Joseph Lister. He greatly improvised on the appliances and instruments he used for surgery and therein lay the success of his surgery. His remarkable surgical skill had a marked impact on his associates.

Kocher was the first to excise the thyroid gland in the treatment of goitre (1876). By 1912, he had performed 5,000 such operations and had reduced the mortality in thyroid surgery from 18 per cent to less than 0.5 per cent, as a result of his application of Lister's antiseptic surgery.

KOCHER, EMIL THEODOR
Switzerland

In 1883, Kocher announced his discovery of a characteristic cretinoid pattern in patients after total excision of the thyroid gland. He also observed that when a portion of the gland was left intact, there were only transitory signs of condition. The disease symptoms described by Kocher (operative myxoedema) were recognized as being analogous to those of the naturally occurring myxoedema. His work helped in the better understanding of thyroid malfunctioning. He observed that hypothyroidism resulted from such conditions as goitre. He gave a tremendous general stimulus to studies on the thyroid, particularly in the search for therapeutic treatment. This led to the introduction of valuable drugs like thyroid and thyroxin.

Kocher's other surgical contributions include a method for reducing dislocation of the shoulder and improvements in operations on the stomach, the lungs, the tongue, the cranial nerves and hernia. The artery forceps and incision in gallbladder surgery that bear his name remain in general use.

Kocher's textbook of operative surgery, *Chirurgische Operationslehre* (1892), was translated into several languages. He also published important books on diseases of the male generative system and of the spinal cord.

Literature

In appreciation of the lofty idealism, vivid imagination and spiritual perception that characterize her writings.

Lagerloef, Selma Ottiliana Lovisa, b.—November 20, 1858, Maerbacka, Vaermland, Sweden, d.—March 16, 1940, Maerbacka. A novelist whose works is rooted in the legends and saga of the Swedish people. She was educated at home and then trained in Stockholm as a teacher. In 1885, she took the job of a schoolteacher at Landskrona. She was a pacifist and a feminist and she interceded through the Swedish Royal family to save the life of the German poetess Nelly Sachs from a German concentration camp in 1940.

An illness left her crippled for a time. She wrote her first novel while she was teaching; the novel appeared in two volumes *Goesta Berlings Saga* (1891, English translation 1898 and 1910). The work was enriched by the tales she heard as a child. In 1894, she published a collection of stories, *Osylinga Laenkar* (Invisible Links, 1899). In 1895, she won a travelling scholarship and gave up teaching and devoted her time entirely to writing. She visited Italy and wrote *Antikrists Mirakler* (1897, English translation 1899), a novel about Sicily. Another collection *En Herrgaerdssaegen* (Tales of a Manor, 1922) is one of her finest works. She spent a winter in Egypt and Palestine and wrote *Jerusalem* 1901-2 (English translation, 1922) in two volumes. The book established her as the leading Swedish novelist.

LAGERLOEF, SELMA OTTILIANA LOVISA
Sweden

Her other notable publications include *Herr Arnes Penninger* (1904, English translation, 1923) and *Nils Holgersons Underbara Resa genom Sverige* (1906-7, English, The Wonderful Adventure of Nils, 1907 and Further Adventures of Nils, 1911). She was very much disturbed during World War I and almost stopped writing. Later however she wrote *Maerbacka* (1922, English 1924); *Ett Barns Memoarer* (1930, Memories of My Childhood, 1934) and the *Diary of Selma Lagerloef* (1932, English 1936). She also wrote a trilogy on Vaermland, *Loewenskoeldska ringen* (1925, The Ring of Loewenskoeldska, 1931); *Charlotte Loewenskoeld* (1925) and *Anna Svaerd* (1928). She was awarded the Swedish Academy's Gold Medal in 1904 and was given an honorary doctorate by Uppsala University in 1907. She was the first woman to be honoured with the Nobel Prize for Literature in 1909 and was also the first Swedish writer to receive it.

Peace

D'Estournelles De Constant, Paul Henri Benjamin Balluet, Baron De Constant de Rebecque (1852-1924). The French nobleman who worked for many years within the international jurist group of Nobel Peace Prize winners, prior to 1914. Actually he did not belong to the legal experts in the real sense of the term. He was trained as a diplomat but he left the diplomatic service in 1895, because as a Counsellor for five years to the French Embassy in London he had realized that the methods of professional diplomacy were incapable of bringing about peaceful co-operation between the countries of Europe.

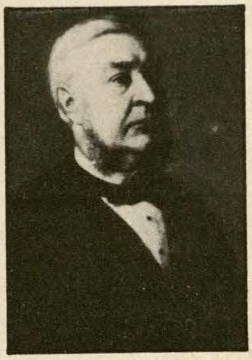
D'ESTOURNELLES DE CONSTANT, PAUL
HENRI BENJAMIN BALLUET, Baron
DE CONSTANT DE REBECQUE
France

He resolved to work for his ideals by active participation in French politics, and was elected a member of the *Chambre des Deputes* for the Sarthé department. Later on he became a Senator. At both The Hague conferences he participated as a French delegate. At the first conference he succeeded in getting *inter alia* the agreement about compulsory arbitration recognized as being a more vitally important mode of settlement of disputes.

In his eyes the idea of arbitration was an ideal to be applied equally in domestic politics, and he looked with favour upon the increased influence which the socialists were acquiring in French politics, and he consistently opposed the Nationalists. In his opinion the "nationalist disease", like certain other ailments, had a tendency to dissipate in more than one direction.

◆

Beernaert, Auguste Marie Francois (1829-1912). A Belgian jurist who was originally a Liberal and a member of a clerical government in 1873. In 1884, he himself formed a government on the same party political basis, and continued as Prime Minister until 1894. In the years that followed he participated, with great enthusiasm, at the international conferences where he strongly advocated arbitration as an effective method for reduction of armaments.



BEERNAERT, AUGUSTE MARIE FRANCOIS
Belgium

As Belgium's first representative at the two Hague Conferences in 1899 and 1907 he had an opportunity of observing how negative were the debates dealing with the question of disarmament. At the same time, he expressed his grave misgivings about the *de facto* recognition of the principle of military occupation, which was the outcome of the two conferences. One of the questions that Beernaert helped to discuss was the treatment of enemy property in naval warfare—he voted in favour of an American proposal for full inviolability except for contraband items. As this proposal had no chance of being adopted, Beernaert suggested the possibility of putting property at sea under the same rules as on land.

Note: The 1909 prize was divided equally between Beernaert and Balluet.

1910

PHYSICS

Van der Waals, Johannes Diderik

CHEMISTRY

Wallach, Otto

PHYSIOLOGY OR MEDICINE

Kossel, Albrecht

LITERATURE

Heyse, Paul Johann Ludwig

PEACE

Bureau International Permanent De la Paix
(Permanent International Peace Bureau)

1910

Physics

For his work on the equation of state for gases and liquids.

Van der Waals, Johannes Diderik, b.—November 23, 1837, Leiden, Netherlands, d.—March 9, 1923, Amsterdam. Born of a poor family, he had to rely largely on his own resources for his education. He taught himself physics, chemistry and mathematics through long solitary hours of study and made enough progress to enter Leiden University in 1862. His treatise on the behaviour of gases and liquids, *On the Continuity of the Liquids and Gaseous State* (1873), received great acclaim, for which he was awarded a doctorate. This provided the foundation for most of his work. In 1877, he was appointed professor of physics at the University of Amsterdam. He was a member of the Academy of Sciences of Amsterdam, and from 1896 to 1912 he was its Secretary.

VAN DER WAALS, JOHANNES DIDERIK
The Netherlands

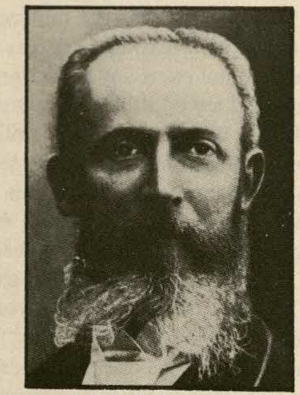
The Ideal Gas Law was derived from the empirical results of Robert Boyle and J.A.R. Charles, but could also be deduced from the Kinetic Theory by assuming that the molecules of a gas were of negligible size compared to its volume, and that they did not exert any attraction on one another. Boyle's Law holds true for simple gases such as hydrogen or nitrogen, but is not entirely accurate for all, especially for those gases that could be easily liquified. Van der Waals realized that the above two assumptions were not right since attractive forces did exist between molecules, and, although molecules were extremely small, they had size. Based on this he worked out a more exact formula in 1873 known as "Van der Waals equation", which is one of the best known equations of state for real gases. Far more complicated than the Ideal Gas Law, his new law was a spectacular success. By formulating this equation, Van der Waals enabled physicists to understand the way in which gases behave under different conditions. These predictions are now put to practical use in almost every engineering situation in which gases play a significant role. Refrigeration and freezing of foods are two good examples. A deeper understanding of his work made possible the first successful efforts to liquify gases such as hydrogen and helium, which produces temperatures approaching absolute zero. This marked the beginning of "cryogenics", the science of low-temperature physics.

The "Van der Waals forces", or the weak affinitive forces between atoms or molecules, were named in his honour.

Chemistry

In recognition of his services to organic chemistry and the chemical industry by his pioneer work in the field of alicyclic compounds.

Wallach, Otto, b.—March 27, 1847, Koenigsberg, Prussia, now Kaliningrad, in Russia, d.—February 26, 1931, Göttingen in West Germany. A chemist who was awarded the prize for analyzing the natural fragrant oils. He studied under Friedrich Woehler at the University of Göttingen and received his doctorate in 1869. He joined August Kekulé at the University of Bonn, where he taught pharmacy and became its professor. From 1889 to 1915 he was director of the Chemical Institute at Göttingen.



WALLACH, OTTO
Germany

While at Bonn, Wallach became interested in the composition of a group of ethereal oils widely used in pharmaceutical preparations. Kekulé denied that they could ever be analyzed. However, Wallach, a master of experimentation, was able to separate the components of complex mixtures by repeated distillation. Then, by studying their physical properties, he could distinguish among the compounds many components which were quite similar to one another. He discovered that most of the oils contained a structure found in the compounds designed as the terpenes.

Physiology or Medicine

In recognition of the contributions to our knowledge of cell chemistry made through his work on proteins, including the nucleic substances.

Kossel, Albrecht, b.—September 16, 1853, Rostock, d.—July 5, 1927, Heidelberg. His father was a merchant and Prussian Consul. After attending the Gymnasium there, he studied medicine at the University of Strasbourg, where he was much influenced by E.F. Hoppe-Seyler (1825-95), one of the pioneers of modern physiological chemistry; he also attended the University of Rostock. He passed his state examination for practice in 1877 and became doctor of medicine in the following year. After assisting Hoppe Seyler for some time, he was summoned by E.Du Bois Raymond to the Physiological Institute in Berlin. In 1895, he became professor of physiology and director of the Physiological Institute at Marburg, where he worked until 1901, when he took over the Heidelberg chair made famous by Willy Mühne and Helmholtz. A physiologist by training, Kossel devoted himself to chemical subjects. His early investigations were concerned with the nucleic acids; later he turned his attention to the protamines of fish roe (first investigated by Miescher), which are comparatively simple proteins, and made a special study of their six-carbon cleavage products, containing nitroten, called "hexone bases". He reached a position of pre-eminence by his substitution of the exact methods of organic chemistry for the less precise means employed by older physiologists.

KOSSEL, ALBRECHT
Germany

He had a number of distinguished pupils, including the Englishman H.D. Dakin. His son, Walther, became a well-known theoretical physicist. At the time of his death, Kossel was emeritus professor of physiology at the University of Heidelberg and director of the Heidelberg Institute for Protein Investigation. For more than thirty years he had been editor of the *Zeitschrift für* *physiologische chemie,* in which most of his writings appeared.

The basic constituents discovered by Kossel in the nucleic acids have now revealed themselves as decisive factors in the transmission of the genetic information of all living organisms.

Literature

As a tribute to the consummate artistry, permeated with idealism, which he has demonstrated during his long productive career as a lyric poet, dramatist, novelist and writer of world-renowned short stories.

Heyse, Paul Johann Ludwig, b.—March 15, 1830, Berlin, d.—April 2, 1914, Munich. A writer and prominent member of the traditionalist Munich School. He was the son of the noted German philologist K.W.L. Heyse. He studied classical and Roman languages and travelled for a year in Italy, supported by a research grant.

HEYSE, PAUL JOHANN LUDWIG
Germany

After completing his studies he became an independent scholar and was called to Munich by Kaiser Maxmilian II of Bavaria. There with the poet Emanuel Geibel, he became the head of the Guild of writers of Munich, who sought out to preserve traditional artistic values from the encroachment of politics, materialism and realism. As a representative of the old classical Romantic culture he became a master short story writer. His works include *L' Arrabiata* (1853; English, 1967), *Andrea Delfin* (1859) and *Bild der Mutter* (Portrait of a Mother, 1859) which are still popular. He also published novels like *Kinder der Welt* (1873; Children of the World, 1882) and a few unsuccessful plays.

Among his best works are his translations of Giacomo Leopardi and other Italian poets. In 1871, he formulated a definition for novella and wrote *Falkentheorie* based on Giovanni Boccacio's model novella, *Tale of a Falcon.* He always refused to portray the dark side of life and became a vehement opponent of the upcoming school of naturalism at that time.

Peace

BUREAU INTERNATIONAL PERMANENT DE LA PAIX (PERMANENT INTERNATIONAL PEACE BUREAU)
Berne

The Nobel Prize for Peace in 1910 was awarded to the *Bureau International Permanent De la Paix* (Permanent International Peace Bureau). Frederik Bajer conceived the idea of establishing the bureau for peace activities. At a congress in London in 1980 a committee was organized and in 1891 an information office of the bureau was established at Bern, Switzerland. It commenced its activities in the same year. The activities consisted in collecting information on institutions, associations and individuals working for peace, and improving contact all round. The Bureau was also to examine and prepare material for discussion at the International Peace Congress, and to see that the resolutions passed at these congresses were actually implemented. It was further supposed to keep itself informed about all publications on peace and the significant events in international politics and international arbitration. Initially, the Bureau was run by one man, the Swiss Nobel Laureate for peace (1902) Elie Ducommun. After his death in 1906, Albert Gobat, also a Swiss Nobel Laureate for peace (1902), took over the direction of the Bureau.

1911

PHYSICS
Wien, Wilhelm

CHEMISTRY
Curie, Marie, née Sklodowska

PHYSIOLOGY OR MEDICINE
Gullstrand, Allvar

LITERATURE
Maeterlinck, Maurice

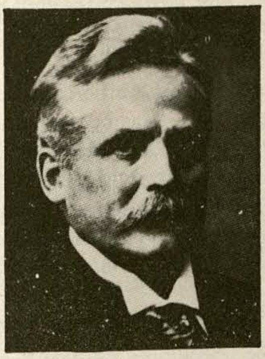
PEACE
Fried, Alfred Hermann
Asser, Tobias Michael Carel

1911

Physics

For his discoveries regarding the laws governing the radiation of heat.

Wien, Wilhelm, b.—January 13, 1864, Gaffken, East Prussia, now in Poland, d.—August 30, 1928 Munich. Son of the landowner Carl Wien, Wien went to school first in Rastenburg in 1879 and later between 1880-82 to the City School at Heidelberg. He went to the University of Göttingen and later to the University of Berlin to study mathematics and the natural sciences. He worked in the laboratory of Hermann von Helmholtz during 1883-86 and obtained his doctorate on the diffraction of light on sections of metals and on the influence of materials on the colour of refracted light.



WIEN, WILHELM
Germany

His studies were interrupted when he had to manage his father's land until 1890. Destiny prevented him from the life of a gentleman farmer when his father's land was sold and Wien returned to Helmholtz's laboratory. Wien was appointed professor of physics at the University of Giessen in 1899 and at the University of Munich in 1920 where he worked for the rest of his life.

He won a prize for his displacement law concerning the radiation emitted by the perfectly efficient blackbody. Because the accuracy of Wien's law was valid only for short waves, Max Planck was led to further researches culminating in his formulation of the quantum theory of radiation. Although the radiation emitted from a blackbody is distributed over a wide range of wave lengths, there is an intermediate wave length at which the radiation reaches a climax. He also made contributions to the study of cathode rays, X-rays, and canal rays. His contribution to physics was aptly summarized by Max von Laue: "His immortal glory was that he led us to the very gates of quantum physics".

Wien married Luise Mehler of Aix-la-Chapelle in 1898. They had four children. His autobiography was published under the title *Aus dem Leben und Wirken eines Physikers* (From the Life and Work of a Physicist, 1930).

Chemistry

CURIE, MARIE, née SKLODOWSKA
France

In recognition of her services to the advancement of chemistry by the discovery of the elements radium and polonium, by the isolation of radium and the study of the nature and compounds of this remarkable element.

Recipient for the second time in a different subject. See under Physics (1903).

Physiology or Medicine

For his work on the dioptrics of the eye.

Gullstrand, Allvar, b.—June 5, 1862, Landskrona, Sweden, d.—July 28, 1930, Stockholm. Studied at Universities of Uppsala, Vienna, and Stockholm. An ophthalmologist, he was awarded the prize for his research on the eye as a light-refracting apparatus. As a professor at the University of Uppsala, Gullstrand contributed to the knowledge of structure and function of the cornea and investigated the cause of astigmatism. He improved corrective lenses for use after surgery for cataracts and devised the "Gullstrand slit lamp", a valuable diagnostic tool that facilitates detailed study of the eye, even today. His investigations led to a new concept of the theory of optical images. He expanded the classic theory of the German physicist Herman von Helmholtz to include the redisposition of internal parts of the lens structure in accommodation, a mechanism by which the eye can focus for near or far objects within certain limits. Gullstrand demonstrated that although accommodation depends about two-thirds on the increase in curvature of the lens surface, the remaining one-third does not.

GULLSTRAND, ALLVAR
Sweden

Literature

In appreciation of his many-sided literary activities, and especially of his dramatic works, which are distinguished by a wealth of imagination and by a poetic fancy, which reveals, sometimes in the guise of a fairy tale, a deep inspiration, while in a mysterious way they appeal to the readers' own feelings and stimulate their imaginations.

MAETERLINCK, Count, MAURICE (MOORIS)
POLIDORE MARIE BERNHARD
Belgium

Maeterlinck, Maurice, b.—August 29, 1862, Ghent, Belgium, d.—May 6, 1949, Nice, France. A symbolist poet and playwright whose rhythmic prose dramas are outstanding in symbolist theatre. He was the most famous of Belgian writers of his time and wrote in French. He became internationally known in the later part of the 19th century.

His first important work was *Serres chaudes* (1889, Ardent Talons), a collection of symbolic poems. He made great impact on the theatre, with his dramas *La Princess Maleine* (1889), *L'Intruse* (The Intruder), *Les Avengles* (The Blind) and *Peleas et Melisande* (1892) (English, 1894, it was produced in the Theatre de l'Oeuvre in Paris) followed by *Aglavaine et Selysette* (1896), which is a world classic. He wrote many other plays including historical dramas, *Monna Vanna* (1902, English, 1904) and *L' Oiseau bleu* (1908, The Blue Bird, 1909), the latter is a play for children and was first performed at the Moscow Art Theatre in 1908. His other compositions include *Le Bourgmestre de Stilmonde* (1918, The Burgomaster of Stilmonde, 1918), *Le tresor des humbles* (1896, The Treasure of the Humble, 1897), *La Sagesse et la destinee* (1893, Wisdom and Destiny, 1901), *L' Intelligence des fleures* (1907, The Intelligence of Flowers, 1907).

His later works, among his finest, include *La vie des Abeilles* (1900, The Life of the Bee), *Le vie de Fourmis* (The Life of the Ant, 1930) and *Le vie des Termites* (1927). *La vie de l'espace* (Life in Space, 1934) was inspired by Einstein. He also wrote his memoirs *Bulles bleues* (Blue Bubbles, 1940). The Academie Francaise, which could not admit him because of his Belgian nationality, awarded him the Medal of the French language in 1948.

Peace

Fried, Alfred Hermann, b.—November 11, 1864, Vienna, d.—May 5, 1921, Vienna. An Austrian pacifist, publicist, cofounder of the German peace movement and co-winner of the prize with Tobias Asser. In 1911, Fried started the pacifist periodical *Die Waffen nieder* (Lay Down your Arms) with Nobel Laureate Bertha von Suttner as its editor. In 1899, he founded another journal *Friedenswaerte* (The Peace Keeper). In 1892, encouraged by Suttner, he founded the *Deutsche Friedensgesellschaft* (German Peace Society), which became the nucleus of the German pacifist movement before World War I. Fried advocated "fundamental pacifism" *(Ursaechlicher Pazifismus)* and believed that "international anarchy" should be met by both legislative measures and spiritual regeneration. Although he had no political effectiveness, Fried influenced some German theorists on international law. With the outbreak of World War I he emigrated to Switzerland in protest against the German policy. As editor of *Blaetter fuer internationale Verstaendigung und zwischenstaatliche Organisation* (Papers for International Understanding and Inter-State Organization), he worked for immediate peace. His works include *Handbuch der Friedensbewegung* (Handbook of the Peace Movement, 1911-13) and *Mein Kriegstagebuch* (My War Diary 1918-20).

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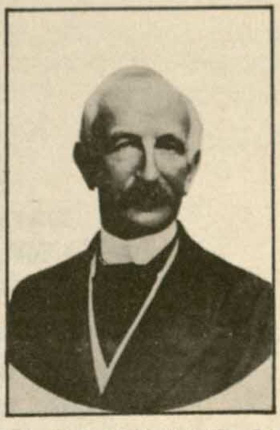
FRIED, ALFRED HERMANN
Austria


ASSER, TOBIAS MICHAEL CAREL
The Netherlands

Asser, Tobias Michael Carel, b.—April 28, 1838, Amsterdam, d.—July 29, 1913. A Dutch jurist and co-winner of the prize for his role in the formation of the Permanent Court of Arbitration at the first Hague peace conference. Asser was professor of commercial and private international law at the University of Amsterdam. In 1869, he, along with two of his associates, started the *Revué de Droit International et de Legislation Comparee* (Review of International law and of Comparative Legislation). He was also a founder of the *Institute de Droit International* (Institute of International Law).

In 1891, Asser prevailed upon the Dutch government to convene The Hague conference for the unification of International Private Law, which first met in 1893 and later became a permanent institution responsible for The Hague treaties concerning family law. In 1911-12, he presided over the conference for the unification of the law relating to international bills of exchange. In 1893, he became a member of the Dutch *Raad van State* (Council of State). Asser was a Dutch delegate to The Hague peace conferences of 1899 and 1907.

Note: The 1911 prize was divided equally between Fried and Asser.

1912

PHYSICS

Dalen, Nils Gustaf

CHEMISTRY

Grignard, Victor / Sabatier, Paul

PHYSIOLOGY OR MEDICINE

Carrel, Alexis

LITERATURE

Hauptmann, Gerhart Johann Robert

PEACE

Root, Elihu

1912

Physics

For his invention of automatic regulators for illuminating lighthouses and buoys.

Dalen, Nils Gustaf, b.—November 30, 1869, Stenstorp, Sweden, d.—December 9, 1937, Stockholm. Son of a farmer, Dalen joined a School of Agriculture to study dairy farming. Later, on the advice of Gustaf de Laval he joined the Chalmers Institute at Göteborg in 1892 and graduated as an engineer in 1896. After a year in Switzerland where he studied under Professor Stodola at the Eidgenossisches Polytechnikum, he returned to Sweden and worked as a consulting engineer. In 1901 he became Technical Chief of the Svenska Karbid—och Acetylen A.B. (Swedish Carbide and Acetylene Ltd) and later joined the Gas Accumulator Company which marketed acetylene gas, and became its Chief Engineer in 1906.

DALEN, NILS GUSTAF
Sweden

The Company was reorganized as Swedish Gas Accumulator Ltd. and Dalen was its Managing Director. He won the prize for his invention of the automatic sun valve, or "Solventil", which regulated a gaslight source by the action of sunlight, turning it off at dawn and on at dusk, or at other periods of impaired visibility during fogs. It rapidly came into worldwide use for marine buoys and unmanned light houses. He did much research on gases and turbines, resulting in improved hot-air turbine engines and the laval steam turbine. He invented "Agamassan", a substance that absorbs acetylene and negates its explosiveness. He was blinded by an explosion during an experiment in 1913, but continued experimental work until his death in 1937. He was given the contract for lighting the Panama Canal. He invented a widely used stove which used just 8 pounds of coal to maintain cooking heat for 24 hours.

Dalen married Elma Persson in 1901; they had two sons and two daughters.

Chemistry

For the discovery of the so-called Grignard reagent, which in recent years has greatly advanced the progress of organic chemistry.

Grignard, Victor, b.—May 6, 1871, Cherbourg, France, d.—December 13, 1935, Lyon. Grignard, whose father was a sailmaker, went to the University of Lyons with the intention of becoming a teacher of mathematics. But he ended up studying organic chemistry and began research to investigate organomagnesium compounds, while a student under Philippe Barbier. He became Professor of Chemistry at Nancy (1910) and at Lyon (1919) on the retirement of Barbier where he remained until his death. During World War I, he worked on several chemical projects for the French Government. In his later years he was busy with his great *traite de chimie organique,* whose volumes began to appear in 1935, but had to be completed by others.

Grignard found that magnesium reacted with many organic halides in ether solution to give compounds which are stable in solution. His doctoral thesis (1901) described the preparation of alcohols, acids, and hydrocarbons by means of reactions of organomagnesium compounds, now generally called Grignard reagents. These reagents have immense potentialities for organic and organometallic synthesis which are even now not exhausted. At the time of his death some 6,000 papers reporting actual applications of the Grignard reaction had been published.

GRIGNARD, VICTOR
France

Grignard spent much of the rest of his career working out some of the implications of his discovery. He also worked on organic compounds of aluminium and mercury, and on terpenes.

Grignard shared the prize with Paul Sabatier. In 1926, he was elected to the *Academie des Sciences.*

◆

For his method of hydrogenating organic compounds in the presence of finely disintegrated metals whereby the progress of organic chemistry has been greatly advanced in recent years.

Sabatier, Paul, b.—November 5, 1854, Carcassone, France, d.—August 14, 1941, Toulouse, France. Sabatier was a student at the *Ecole Normale,* Paris, and became assistant to M. Berthelot at the *College de France,* from where he obtained his Ph.D. in 1880. In 1884 he was appointed Professor of Chemistry at the University of Toulouse, a post he held until his retirement in 1930, despite an offer at the Sorbonne. He was a good teacher, and continued to lecture almost to the end of his life. He was married and had four daughters.

SABATIER, PAUL
France

The early researches of Sabatier were in the field of inorganic chemistry. He worked on hydrogen disulphide, metallic nitrides and heats of reaction. Later, he studied the catalytic effect of inorganic compounds, especially finely divided metals, on organic reactions, particularly in the gas phase. He did this work in collaboration with the Abbe Senderens who was a teacher in a Catholic college in Toulouse. In 1897, Sabatier showed how various organic compounds could undergo hydrogenation, e.g. ethylene will not normally combine with hydrogen, but when a mixture of the gases is passed over finely divided nickel, ethane is produced. Benzene can be converted into cyclohexene in the same way. This work made possible important innovations in industrial chemistry, his study of catalysis involved investigations into the specificity of catalysts, "catalyst poisoning" and the use of heavy metal-oxides for catalysing hydration-dehydration reactions. Sabatier discussed his studies in *La Catalyse en Chimie Organique* (1912), whose theoretical views have stood the test of time.

Sabatier was awarded the prize for his work on catalytic hydrogenations, which he shared with F.A.V. Grignard. In recognition of his work, he was also elected the first non-resident member of the *Academie des Sciences* (1913).

Note: The 1912 prize was equally divided between Grignard and Sabatier.

Physiology or Medicine

In recognition of his work on vascular suture and the transplantation of bloodvessels and organs.

Carrel, Alexis, b.—June 28, 1873, Sainte-Joy-les-Lyon, France, d.—November 5, 1944, Paris. Carrel received his doctorate in 1900 from the University of Lyon, where he began his research work and remained as prosector for two years. He left for the US in 1904 and joined the University of Chicago. In 1906 he joined the Rockefeller Institute in New York, where he did his brilliant studies on the suturing of blood vessels and on transplanting organs. In 1941, he became Director of the Carrel Foundation for the study of human problems in Paris, a post he held until his death in 1944.

CARREL, ALEXIS
France

In 1902 Carrel began studying the anastomosing of vessels. He systematically analysed all possible complications and developed techniques to overcome the development of thrombosis or stenosis, the causes of failure in transplanting organs. His techniques involved the overcoming of causes of failure such as enforcement of rigid asepsis. He paid careful attention to details about the use of instruments, needles and suturing. He developed a method of suturing blood vessels and laid the ground for studies on transplantation of blood vessels and organs.

With the help of his new techniques, Carrel was able to remove entire organs such as the kidney and to replace them in their original location or occasionally, in different parts of the body where they still functioned. His work helped a long way in the advancement of vascular surgery. His techniques also found application in transfusing blood from donor to recipient, a technique used before methods of preventing blood coagulation had been found.

During World War I Carrel returned to France and joined the Army where he helped to develop the "Carrel-Dakin" method of treating wound infections with continuous antiseptic irrigations. After 1919, he continued his work at the Rockefeller Institute until World War II, when he served on a mission for the French Ministry of Public Health (1939-40) In 1935, he, along with Colonel Charles A. Lindbergh of the "Spirit of St. Louis" fame, developed a mechanical heart with which animal heart and kidney could be kept alive *in vitro* by perfusing artificial blood. He also investigated the preservation of tissue outside the body, and the application of the process to surgery. His strain of chick heart tissue was kept alive for more than 30 years.

Carrel wrote popular books like *Man, the Unknown* (1935), *The Culture of Organs* with C.A. Lindberg (1938), *Reflections on Life* (1952), and *Treatment of Infected Wounds.*

Literature

Primarily in recognition of his fruitful, varied and outstanding production in the realm of dramatic art.

HAUPTMANN, GERHART JOHANN ROBERT
Germany

Hauptmann, Gerhart Johann Robert, b.—November 15, 1862, Obersalzbrunn, Silesia (now in

Poland), d.—June 6, 1946, Agnetendorf, Germany. Went to school in Breslau which he described as a "time of everlasting toothache"

He is one of the most controversial figures of German literary history. His work is extremely varied in style and in form. His works may be divided chronologically into three periods: naturalistic, neo-romantic and classicistic. For him life and writing were synonymous. His own experience is revealed throughout his works. His social plays in Silesian and the Berlin dialects brought him international fame

He left school at the age of 15 and studied sculpture at Breslau, then turned to history, philosophy and science in succession. He lived in Rome (1883-84) to improve upon his skill of sculpting. As a writer he became famous with *Vor Sonnenaufgang* (Before Dawn, 1889). His other works include *Einsame Menschen* (Lonely Souls, 1891), *Die Weber* (The Weavers, 1892) and *Pippa Dance* (1906), based on his love affair with a 17-year-old actress. He also wrote a number of plays.

Peace

Root, Elihu, b.—February 15, 1845, Clinton, New York, d.—February 7, 1937, New York City. A lawyer and a successful statesman. He received his law degree from New York University in 1867. His practice, involving city government, brought him into close contact with the Republican political leader Theodore Roosevelt.

As Secretary of War in President William McKinley s cabinet, he worked out governmental arrangements for the former Spanish colonies under American control. His recommendations resulted in the passage of the Foraker Act (1900), which provided for civil government in Puerto Rico. He established American authority in the Philippine Islands and wrote the instructions for an American governing commission sent there.

In the area of military reform, he effected a reorganization of the army, established the principle of rotation from staff of line, and created the Army War College in 1901.

ROOT, ELIHU
USA

He left the Cabinet in 1903 but returned as Secretary of State in 1905 under President Theodore Roosevelt and worked until 1909. On a tour of South America he persuaded the Latin-American States to participate in the Second Hague Peace Conference, and negotiated an agreement by which Japan undertook to control its emigration to the USA. He concluded treaties of arbitration with most of the European nations. Later, as Chief Counsel for the USA before The Hague Tribunal, he settled the controversy between the USA and the British over the North Atlantic Coast fisheries.

Note: The Nobel peace prize of 1912 was kept reserved and awarded to Root in 1913.

1913

PHYSICS
Kamerlingh-Onnes, Heike
CHEMISTRY
Werner, Alfred
PHYSIOLOGY OR MEDICINE
Richet, Charles Robert
LITERATURE
Tagore, Rabindranath
PEACE
La Fontaine, Henri

1913

Physics

For his investigations on the properties of matter at low temperatures which led, inter alia, to the production of liquid helium.

Kamerlingh-Onnes, Heike, b.—September 21, 1853, Groningen, Netherlands, d.—February 21, 1926, Leiden. Son of Harm Kamerlingh-Onnes, owner of a brickworks near Groningen, and Anna Gerdina Coers. After his initial education in his native town, he entered the University of Groningen in 1870 and obtained *candidaats* degree (equivalent of B.Sc) the following year. He studied under Robert Bunsen and Gustav Kirchhoff in Heidelberg for nearly two years. He passed his "doctoral" (equivalent of M.Sc) examination from Groningen in 1878 and obtained his doctorate in 1879 on "New Proofs of the Rotation of the Earth"

KAMERLINGH-ONNES, HEIKE
The Netherlands

Kamerlingh-Onnes became assistant to Bosscha at the Polytechnicum at Delft in 1878 and also lectured in his place in 1881 and 1882. From 1882 to 1923 he served as Professor of Experimental Physics at the University of Leiden.

Influenced by the work of Johannes van der Waals, he investigated the equation describing the states of matter and studied the general thermodynamic properties of liquids and gases over a wide range of pressure and temperatures. In 1894, he founded and built up the famous Cryogenic Laboratory (now known by his name) that established Leiden as the low-temperature research centre of the world. From 1895 to 1906 he concentrated on perfecting cryogenic experimental physics. Having built an improved hydrogen-liquefaction machine he succeeded in liquefying helium. Subsequent attempts to solidify helium were fruitless until his student and successor Willem Hendrik Keesom, succeeded to do it in 1926.

He discovered superconductivity, the almost total lack of electrical resistance by certain materials when cooled to a temperature near absolute zero. Superconductivity pioneered by Kamerlingh-Onnes has since produced 9 Nobel Laureates the latest being awarded in 1986.

In 1887, he married Maria Adriana Wilhelmina Elisabeth Bijleveld and had one son.

Chemistry

In recognition of his work on the linkage of atoms in molecules by which he has thrown new light on earlier investigations and opened up new fields of research especially in inorganic chemistry.

Werner, Alfred, b.—December 12, 1866, Mulhouse, France, d.—November 15, 1919, Zuerich. Werner earned his Ph.D from the University of Zuerich for his work with Arthur Hantzsch on the organonitrogen oxime compounds. His exploration of the three-dimensional arrangement of those parts of an oxime molecule linked directly to the nitrogen atom proved to be a valuable contribution in stereochemistry. He subsequently worked with Marcelin Berthelot at Paris and returned to Zuerich in 1891, where he taught from 1893 until his demise. He was reputed to be an excellent teacher.

WERNER, ALFRED
Switzerland

In 1891, Werner presented his great contribution, coordination theory, which permitted a simple classification of inorganic compounds and extended the concept of isomerism. He and his students prepared many new series of compounds and fitted them into the new system. Though his views have been modified slightly, they are fundamental in inorganic chemistry and paved the way for the modern concepts in chemical bonding.

Physiology or Medicine

In recognition of his work on anaphylaxis.

Richet, Charles Robert, b.—August 26, 1850, Paris, d.—December 4, 1935, Paris. Son of a Professor of Clinical Surgery, Charles graduated in medicine in 1876 from the Paris University. He won the prize for his work on "anaphylaxis", his term for the fatal reaction by a sensitized individual to a second injection of an antigen. His research helped to elucidate problem of hay fever, asthma, and other allergic reactions to foreign substances and explained some cases of intoxication and sudden death not previously well understood. Richet taught at the University of Paris and was co-director of the *Revue Scientifique*. He is known for his investigations into the physiology of respiration and digestion, as well as epilepsy, the regulation of body heat, and a wide array of other subjects. Richet was a man of many interests. He was distinguished as a bacteriologist, pathologist, medical statistician and was deeply interested in literature.

RICHET, CHARLES ROBERT
France

Literature

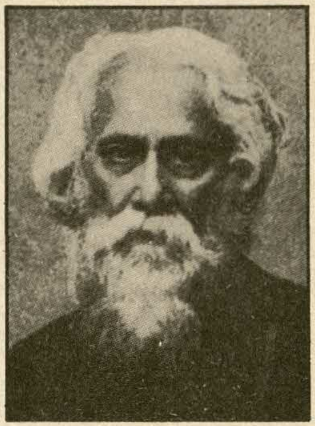
Because of his profoundly sensitive, fresh and beautiful verse, by which, with consummate skill, he has made his poetic thought, expressed in his own English words, a part of the literature of the West.

Tagore, Rabindranath, b.—May 7, 1861, Calcutta, India, d.—August 7, 1941, Calcutta. A Bengali poet and mystic who introduced the best of Indian culture to the countries of the West and vice versa. He had no formal schooling but was tutored at home by the leading intellectuals of Calcutta.

He began to write very early in his childhood and published *Manashi* (1890), a collection of poems that marked the rapid maturity of his genius. It contains many of his famous poems, including several written in verse form yet unknown to Bengali literature. Some of the poems had social and political thoughts.

In 1891, he went to manage his father's estates in Shilaidaha and Sahazadpur, both now in Bangladesh. There he lived in close contact with poor and simple village people and developed sympathy for their poverty and backwardness, which was reflected in his later writings. Stories on their humble lives and sorrows were collected in *Galpa Guccha* (1912, Bunches of Tales).

In Shilaidaha, he came in close contact with the most versatile mystic of his time, Lalan Fakir, and studied his vast collection of poems. He came to love the idyllic surroundings of the North Bengal countryside; river Padma captured his imagination. During those years he published several collections of poems like, *Sonar Tari* (1893, The Golden Boat), *Chitra* (1896), *Chaitali* (1896, Late Harvest), *Kalpana* (Dreams) and *Ksanika* (both in 1900), *Naivedya* (1901, Offerings) and two lyrical plays *Chitrangada* (1892, English translation, Chitra, 1913) and *Malini* (1895).



TAGORE, RABINDRANATH
India

Events of profound sorrow like the death of his wife and youngest son Samindranath inspired some of his best poems. The English version of his most famous collection of poems, *Gitanjali* (1910) attracted the attention of Western scholars and won him the prize.

In 1915, he was knighted by the British Government but he relinquished the title in 1919, as a protest against the merciless killing of women and children by British soldiers at Jalianwalabagh in Punjab. He was a prolific writer; in the last 25 years of his life he produced 21 collections of poems. Many of his works were translated into English by himself.

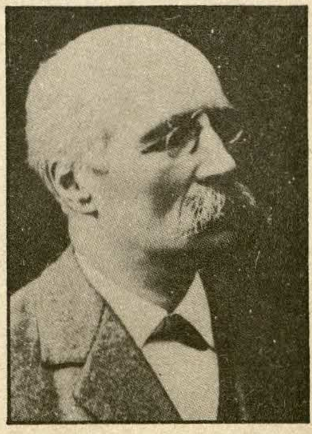
His novels although much less outstanding than his poems and short stories are worthy of attention. The most famous of his novels *Gora* (1910, English translation, 1924) was dramatized and filmed.

He was a gifted musical composer with the knowledge of both classical Indian music and Western music, and set hundreds of his poems to music. He was also one of the foremost painters in India. In 1901, he founded his model school at Shantiniketan (abode of peace), a place near Bolpur not very far from Calcutta. There he sought to blend the best of the East and West and to impart it to the young minds. In 1924, he inaugurated the Visva Bharati University which attracted many renowned scholars.

The National anthems of India and Bangladesh, *Jana Gana Mana* and *Amar Sonar Bangla...* respectively, are his compositions. The National anthem of Sri Lanka is also based on his famous poem *Chitta Jetha Vaya Sunya.* Tagore is often referred to as *Visvakavi,* meaning the poet of the universe! He is the first Asiatic Nobel Laureate.

Peace

La Fontaine, Henri, b.—April 22, 1854, Brussels, d.—May 14, 1943, Brussels. An international lawyer and president of the International Peace Bureau (1907-43). He studied law at Brussels University. He was admitted to the bar in 1877 and established a reputation as an authority on international law. In 1893, he became professor of international law at the *Université Nouvelle* in Brussels and two years later was elected to the



LA FONTAINE, HENRI
Belgium

Belgian Senate as a member of the Socialist Party. He served as Vice-Chairman of the Senate from 1919 to 1932.

La Fontaine took an early interest in the International Peace Bureau, founded in 1882, and was influential in the Bureau's efforts to bring about The Hague Peace Conference. He was a member of the Belgian delegation to the Paris Peace Conference in 1919 and to the League of Nations Assembly (1920-21). In his efforts to foster world peace, he founded the *Centré Intellectual Mondial* (World Intellectual Centre) and proposed such organizations as a world school and university, a world parliament, and an international court of justice. La Fontaine was the author of a number of legal handbooks and a documentary history of international arbitration. Among other works are *Bibliographie de la paix et de l'arbitrage international* (Docmentation on Peace and International Arbitration, 1904) and *The Great Solution* (1919). He was founder of the review, *La Vie International*.

1914

PHYSICS
Theodor Felix von Laue, Max
CHEMISTRY
Richards, Theodore William
PHYSIOLOGY OR MEDICINE
Barany, Robert

1914

Physics

For his discovery of the diffraction of X-rays by crystals.

Theodor Felix von Laue, Max, b.—October 9, 1879 in Pfaffendorf near Koblenz, b.—April 24, 1960, Berlin. Son of Julius von Laue, a high-ranking administrative officer, he could have easily embarked on one of the traditional careers befitting a bourgeois, in the administration, the armed forces or the legal profession. But during his schooling in Berlin, he developed interest in science. He therefore studied mathematics, physics and chemistry first in Strasburg and later in Goettingen. In the process, he very quickly made theoretical physics his special field. It presented him with the unique opportunity of saying something about nature with mathematical methods. Although he later repeatedly emphasized that mathematics conveys the experience of truth in its purest and most immediate form, his interest in it was at its greatest only when a physical application seemed possible.

THEODOR FELIX VON LAUE, MAX
Germany

Laue took his doctorate in Berlin in 1903, qualified as a university lecturer there in 1906 before going in 1909 as a lecturer to Munich where Roentgen was working. There he was entrusted with drafting the volume on Wave theory in the *Encyclopaedia of Mathematical Sciences* which was a decisive stimulus, as it gave him the idea in the spring of 1912 of emitting X-rays through copper sulphate crystals. He took photographs of the radiation which has passed through and discovered X-ray interference : the effect of diffraction on an X-ray beam passing through crystals is subjected to.

He succeeded in demonstrating the very short wave length of X-ray light and the lattice structure of crystals, consisting of atoms or atomic residues. This ushered in a new age of X-ray crystallography which as an auxilliary science brought a whole series of decisive advances overnight not only to mineralogy, but also to physics, physical chemistry, metallography and material testing. Laue's discovery represented conclusive proof of the atomic structure of matter which until that time had only been an assumption, a scientific hypothesis.

Only two years later, he was awarded the prize for his work on X-ray crystallography which marked the beginning of solid state physics.

After an interlude in Zuerich from 1912 to 1914, he was offered a chair at the newly founded University of Frankfurt in 1914. In 1919, he went to Berlin where he worked until 1943.

Along with Max Planck, he was Professor of Theoretical Physics. At the Kaiser Wilhelm Institute of Physical Research (today all these institutes are named after Max Planck), he addressed himself to the promotion of scientific research as assistant to, and in conjunction with, Albert Einstein.

His book *History of Physics,* which appeared in 1947 during the miserable period immediately after the war, gave a remarkably lucid account of a substantial field of the natural sciences and, in the process, shed light on the development of human consciousness.

Towards the end of the war he moved to Göttingen together with Max Planck, ran his old institute there for a while again after 1945. But then he returned to Berlin. From 1951 to 1959 he was director of the Fritz Haber Institute of the Max Planck Society in Berlin-Dahlem. He also helped in the establishment of the Hahn-Meitner Institute for Nuclear Research, named after Otto Hahn and Lise Meitner, who were ethnic Jews.

In 1957, he returned to the public eye. He was one of the 18 leading German nuclear physicists who warned of the dangers of nuclear arms and spoke out against equipping the then newly founded Federal German Armed Forces with these weapons.

Max von Laue received several honorary doctorates, admission in 1952 to the Peace class of the "Pour le merite" order re-founded by Theodor Heuss, the first Federal President, the Officer's Cross of the French Legion of Honour in 1957 and membership of many scientific academies and bodies in and outside the Federal Republic of Germany.

Chemistry

In recognition of his accurate determinations of the atomic weight of a large number of chemical elements.

RICHARDS, THEODORE WILLIAM
USA

Richards, Theodore William, b.—1868, German town, Pennsylvania, d.—1928, Cambridge, Massachusetts Graduated from Haveford in 1885 and received his Ph.D. from the Harvard University in 1888 for determining the atomic weight of oxygen. He worked on thermodynamics, perfected the thermochemical measurements and devised "adiabetic calorimeter". He also worked on the relation between physical properties of various elements and their compounds. He received the prize for his fundamental works on atomic weights, as he determined the atomic weights of approximately sixty elements and indicated the existence of isotopes. He was the first American to receive the Nobel Prize.

Physiology or Medicine

BARANY, ROBERT
Austria

For his work on the physiology and pathology of the vestibular apparatus.

Barany, Robert, b.—April 22, 1876, Vienna, d.—April 8, 1936, Uppsala, Sweden. Studied at the University of Vienna. An otologist, he won the prize for his work on the physiology and pathology of the vestibular (balancing) apparatus of the inner ear.

His name is associated with tests for detecting vestibular diseases and for examining activities of the cerebellum and their relation to disturbances of equilibrium. Barany graduated in medicine in 1900. After study at various German clinics he became an assistant at the oto-rhino-laryngology clinic of the University of Vienna and, in 1909, he became a lecturer in otology.

During World War I he was imprisoned as a Russian Prisoner of War in Siberia, and was released through the intercession of the Swedish Red Cross. He received his Nobel award through diplomatic channels. From 1917 until his death he taught at the Uppsala University, where he was the head of the ear, nose, and throat clinic.

1915

PHYSICS

Bragg, Sir William Henry
Bragg, Sir William Lawrence

CHEMISTRY

Willstätter, Richard Martin

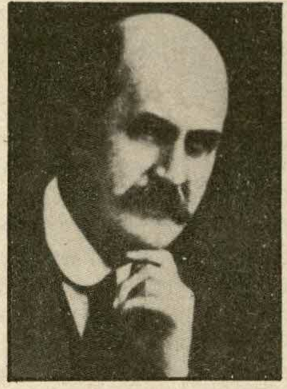
LITERATURE

Rolland, Romain

1915

Physics

For their services in the analysis of crystal structure by means of X-rays.



BRAGG, Sir WILLIAM HENRY
Great Britain

Bragg, Sir William Henry, b.—July 2, 1862, Westward, Cumberland, England, d.—March 10, 1942, London. Eldest son of Robert John Bragg, a farmer, and Mary Robert Wood. Educated at King William's College, Isle of Man, he entered Trinity College in 1881 as a scholar and graduated as Third Wrangler in 1884. After a short stint in Cambridge, Bragg became professor of mathematics and physics in Adelaide in 1886. In 1889 he married Gwendoline, daughter of Sir Charles Todd; they had two sons and a daughter. In 1908 he returned to England as Cavendish Professor at Leeds, and in 1915, after the war he took up Professorship at University College, London—a post he held until 1923. World War I interrupted his academic work and for some time Bragg served the Navy where he worked on the development of the hydrophone used in the detection of submarines. During the war in 1915 he lost his younger son at Gallipoli. His elder son Lawrence Bragg became a distinguished physicist and together father and son worked on the problems of X-rays, studying ionization and the structure of atoms in crystals. In 1923, he became Fullerian professor of chemistry at the Royal Institution and Director of Davy-Faraday Laboratory where he worked until his death. During this time he was renowned both as a writer and lecturer. His Riddell Memorial lectures were published as *Science and Faith* (1941). Elected FRS in 1907, he was President of the Royal Society during 1935-40. His published works include *The World of Sound* (1920) and *Concerning the Nature of Things* (1925).

In 1912, Max Von Laue, W. Friedrich and P. Knipping discovered the diffraction of X-rays by crystals. Bragg saw its importance in relation to corpuscular and wave theories of X-rays. He also reinterpreted Von Laue's theory of diffraction of X-rays by a crystal acting as a three-dimensional grating. He was joined by his son William Lawrence Bragg, and, in about three years, they worked out for the first time the atomic structure of crystals, thereby founding the modern science of crystallography.

In 1912, Bragg developed a prototype diffractometer, an instrument used in the study of X-ray crystallography. His X-ray spectrometer superseded Von Laue's photography as a means of getting X-ray diffraction information.

◆

For their services in the analysis of crystal structure by means of X-rays.

Bragg, Sir William Lawrence, b.—March 31, 1890, Adelaide, South Australia, d.—July 1, 1971, London. The elder son of Sir William Henry Bragg and Gwendoline Todd, Bragg was educated at St. Peter's College, Adelaide, until 1909 when he entered Trinity College, Cambridge, as a scholar. He assisted his father in research on the geometrical arrangement of atoms in crystals by studying the diffraction pattern of X-rays while he was still in college. In 1914, he became a Fellow of Trinity College and a lecturer in natural sciences. He was Professor of Physics at Manchester (1919), Director of National Physical Laboratory (1937), succeeded Sir Ernest Rutherford as Cavendish Professor of Experimental Physics at Cambridge (1938)—a post he held until 1953. He then became like his father Fullerian Professor of Chemistry and Resident Professor and Director of the Royal Institute of Great Britain (1953-66), where he worked on the structure of proteins. Throughout the course of his career Bragg won many academic awards and honours. In 1941 he was knighted.

BRAGG, Sir WILLIAM LAWRENCE
Great Britain

Bragg and his father worked on diffraction of X-rays to study the arrangement of atoms in crystals and postulated Bragg's Law of X-ray diffraction'—which work won them the Nobel Prize for Physics in 1915. Till date, Sir William Lawrence Bragg remains the youngest person ever to have received a Nobel Prize. He won it at the age of 25. Although he began his research with study of crystalline structures of simple substances like diamond and copper, he later showed great interest in the study of complex substances especially silicates. In the laboratories he directed, he gathered teams from all over the world who worked on complex structures like metallic alloys, and biological molecules such as DNA and the proteins myoglobin and haemoglobin.

Bragg had a quality of verbal and visual clarity. He took pleasure in the simple and, whenever possible, visual presentation of his ideas making full use of his skill for drawing and painting. He could develop optical analogues of diffraction patterns or of atomic distribution in crystals with ease. In 1965, the Nobel Foundation invited him to deliver a guest lecture—the first ever—on the developments in his field of interest during the last 50 years.

Note: The 1915 prize was awarded jointly to Henry and Lawrence Bragg.

Chemistry

For his researches on plant pigments, especially chlorophyll.

Willstätter, Richard Martin, b.—August 13, 1872, Karlsruhe, now in West Germany, d.—August 3, 1942, Locarno, Switzerland. A chemist whose study of the structure of chlorophyll and other plant pigments won him the prize. He obtained his doctorate from the University of Munich (1894) for work on the structure of cocaine. While serving as an assistant to Adolf von Baeyer at Munich he continued research into the structure of alkaloids and synthesized several of them.

WILLSTÄTTER, RICHARD MARTIN
Germany

In 1905, he was given a professorship at Zuerich and began working on chlorophyll. He elucidated its structure and showed that the blood pigment heme bears a structural resemblance to the porphyrin compound found in chlorophyll. He was professor of chemistry in the University of Berlin and director of the Kaiser Wilhelm Institute at Berlin (1912-16), where his investigations revealed the structure of many of the pigments of flowers and fruits. When his work was interrupted by the war, he turned his attention to the development of a gas-mask.

In 1916, Willstätter succeeded Baeyer at Munich. During the 1920s he investigated the mechanisms of enzyme reactions and did much to establish that enzymes are chemical substances and not biological organisms. His view of enzymes as nonprotein in nature was widely held until disproved in 1930. Being a Jew, he resigned his post at Munich in protest against anti-Semitic policies. He continued his work privately, first in Munich and, from 1939 onwards, in Switzerland.

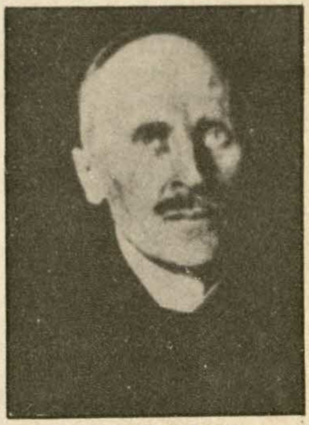
Literature

As a tribute to the lofty idealism of his literary production and to the sympathy and love of truth with which he has described different types of human beings.

Rolland, Romain, full name Romain Edme Paul-Emile Rolland, b.—January 29, 1866, Clamecy, France, d.—December 30, 1944, Vezelay. A novelist, dramatist, essayist and one of the greatest mystics in French literature. At the age of 14 he went to Paris for study and formed a society to uplift spiritual disarray. He was admitted into the *L'Ecole Normale Superieure* and lost his religious faith. He discovered the writings of Spinoza and Tolstoy and developed a passion for music. He studied history and received doctorate in art (1895).

He went on a two-year mission to Italy at the *Ecole Francaise de Rome.* In 1912, after a brief teaching career in art and musicology he devoted his whole time to writing. He collaborated with Charles Peguy in the journal *Les Cahiers de la Quinzaine,* where his best known novel *Jean Christophe* first appeared in 1904-12. For this and his pamphlet *Au-dessue de la melee* (1915, Above the Battle) he was much respected.

He was deeply involved in the major social, political and spiritual events of his time. The scandalous "Dreyfus Affair" which exposed the dormant anti-semitism in France also attracted his attention and criticism. He promoted pacifism, communism and the fight against fascism. At first he wrote plays but was unsuccessful in his attempts to gain acceptance from the discerning French audience. He collected his plays in two cycles : *Les Tragedies de la foi* (1913) which contained *Aert* (1898); and *Le Theatre de la revolution* (1904) which contained a presentation on the Dreyfus Affair, *Les Loups* (1898, The Wolves, 1937) and *Danton* (1900, English 1918). His passion for heroism found a place in a series of biographies of great men such as *Vie de Beethoven* (1903, English 1907), *Vie de Michel Ange* (1905, English, 1912) and *Vie de Tolstoi* (1911). In his masterpiece *Jean Christophe* he introduced the *roman fleuve* to French literature. It presents the successive crises confronting a musical genius of German extraction, Jean Christophe Kraft, who was portrayed half like Beethoven and half like his own self. This synthesis of a young German and a young French man symbolizes the symbiosis of opposite characters. Rolland believed that the portrayal of Jean Christophe could eventually establish good relations between nations. He wrote a burlesque fantasy, *Colas Breugnon,* (1919) and a second novel cycle *L'Ame-enchantee* (in 7 vols, 1922-33 & 1954). The novel exposed the cruel effects of political sectarianism.



ROLLAND, ROMAIN
France

In the 1920s he turned his attention to Asia, specially to India, in an attempt to interpret its mystical philosophy to the West through such books as *Mahatma Gandhi* (1924). His vast correspondences with universally admired men of his time, such as Albert Schweitzer, Albert Einstein, Bertrand Russel, and Rabindranath Tagore were published in the *Cahiers Romain Rolland* (1940). His posthumously published *Memoirs* (1956) and private journals bear witness to his exceptional integrity and love for the entire human race.

Note: The Nobel Prize in Literature was kept reserved in 1915 and was awarded to Romain Rolland in 1916.

1916

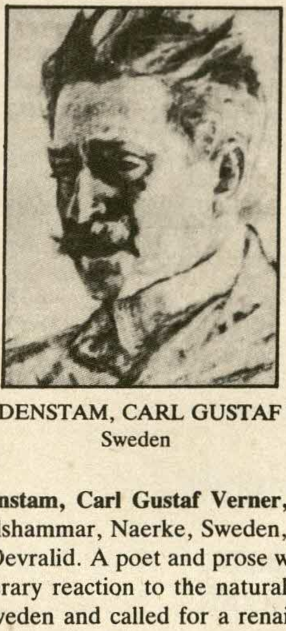
LITERATURE

Von Heidenstam, Carl Gustaf Verner

1916

Literature

In recognition of his significance as the leading representative of a new era in our literature.



VON HEIDENSTAM, CARL GUSTAF VERNER
Sweden

Von Heidenstam, Carl Gustaf Verner, b.—July 4, 1859, Olshammar, Naerke, Sweden, d.—May 20, 1940, Oevralid. A poet and prose writer who led the literary reaction to the naturalist movement in Sweden and called for a renaissance of the literature of fantasy, beauty and national themes. Ill health compelled him to spend most of his youth in the central and eastern Mediterranean countries.

His first book of poems, *Vallfart och vandringsaer* (1888, Pilgrimage: The Wander Years) is full of fables of southern Europe and the philosophy of the East. It was followed by his great prose-poem *Hans Alienus* (1892). He voiced his opposition to naturalism with his essay, *Renassans* (1899). He endeavoured to make new realization of Swedish literature through his works, *Dikter* (Poems, 1895), *Ett Folk* (One People, 1902), and *Nya Diktar* (1915). He also wrote several volumes of historical fiction, the most important of which are *Karolinerna,* 2 vols (1897-98, The Charles men, 1920, 1933) *Heliga Birgittas pilgrimsfard* (The Pilgrimage of Saint Bridget, 1901) and *Folkunga Traedet,* (1905-07, The Tree of Folkungs, 1925) and *Bjaelborarvet* (The Bjaelbo Inheritance, 1905-07).

After the turn of the century his works lost popularity and he was virtually inactive during the last 25 years of his life. *Naer Kastanjerna blommade* (When the Chestnuts Bloomed, 1941) belongs to this period and was published posthumously.

1917

PHYSICS

Barkla, Charles Glover

LITERATURE

Gjellerup, Karl Adolph / Pontoppidan, Henrik

PEACE

Comité International de la Croix-Rouge
(International Committee of the Red Cross)

[illegible]
[illegible]

[illegible]
[illegible]

[illegible]
Comité International de la Croix-Rouge
(International Committee of the Red Cross)

1917

Physics

For his discovery of the characteristic Rontgen radiation of the elements.

Barkla, Charles Glover, b.—June 7, 1877, Widnes, Lancashire, d.—October 23, 1944, Edinburgh. Son of J.M. Barkla, Secretary to the Atlas Chemical Company, Barkala was educated in Liverpool. He entered the University College, Liverpool, in 1894 to study mathematics and physics and graduated with first class honours in physics in 1898. He worked under J.J. Thomson in the Cavendish Laboratory in Trinity College and later moved to King's College, Cambridge.

BARKLA, CHARLES GLOVER
Great Britain

He joined the faculty of the University of Liverpool in 1902 as Oldver Lodge Fellow and was successively demonstrator, assistant lecturer and special lecturer in electricity between 1905 to 1909. He became the Wheatstone Professor of Physics at the University of London in 1909. He became a professor of natural philosophy of the Edinburg University in 1913. In 1906 he alongwith C.A. Sadler used X-ray scattering to determine the number of electrons in the carbon atom. He was also able to polarize X-rays and demonstrated that X-rays are transverse waves which are probably electromagnetic in nature as light is. He won the prize for his fundamental work on X-ray scattering. This technique was very helpful in the study of atomic structures.

He married Mary Esther, daughter of John T. Cowell in 1907; they had two sons and one daughter. Barkla was a good singer. He was a member of the King's College Chapel Choir, 1901-2. Another love he picked up in the latter part of his life was golf.

Literature

For his varied and rich poetry, which is inspired by lofty ideals.

Gjellerup, Karl Adolph, b.—June 2, 1857, Roholte, Denmark, d.—October 11, 1919, Klotzsche, East Germany. A poet and novelist. His efforts to portray and to caricature the narrowness of the

GJELLERUP, KARL ADOLPH
Denmark

Danish people of high standing are still greatly appreciated in Denmark. He was the son of a padre and studied theology initially but after coming under the influence of Darwinism and the radical ideas of Georg Brandes took to atheism. This atheism motivated his break with Christianity.

He proclaimed in his first book *En Idealist* (1878, An Idealist) and *Germanernes laerling* (1882, The Apprentice of the Teutons) his conversion to atheism. He wrote verse tragedies like *Brynheld* (1884), *Hagbard og Sign* (1888), *Herman Vandel* (1891), *Wuthhorn* (1893), *Kong Hjarne* (1893), *Gift og modgift* (1898).

In the later part of his life he developed liking for Buddhist philosophy and Oriental religions. His works include *Minna* (1889, English, 1913), *Pastor Mors* (German, 1894), *Mollen* (The Mill, 1896), a novel on contemporary Germany, *Der Pilger Kamanita* (1906, The Pilgrim Kamanita, 1911), an exotic tale of reincarnation set to scene in India, and *Die Weltwanderer* (The world travellers, 1910), also set in India. He shared the prize alongwith his fellow Dane Pontoppidan. ◇

For his authentic descriptions of present-day life in Denmark.

PONTOPPIDAN, HENRIK
Denmark

Pontoppidan, Henrik, b.—July 24, 1857, Fredericia, Denmark, d.—August 21, 1943, Ordrup, Denmark. A realist writer whose father was a clergy. It was partly in protest against his father's religiousness that he went to study engineering in Copenhagen.

In 1879, he broke off his studies and took to teaching for a few years. His first collection of short stories, *Staekkede Vinger* (Clipped Wings) was published in 1881 and thereafter he supported himself only by writing until 1900 when he became a journalist attached to several Danish papers. His novels and short stories are written in a placid, epic style which stretches over half a century and covers most aspects of Danish life. Those evoked a desire for social progress, but were despairing to many.

His first books were mainly descriptions of country-town life. *Landsbybilleder* (1883), *Fra Hytterne* (1887) and *Skyer* (1890) are all characterized by social indignation. The trilogy *Det Forjaettede land* (1891-95, The Promised Land) describes the religious controversies in districts. The principal character is a padre from Copenhagen, a dreamer who tries, unsuccessfully, to gain the confidence of peasants. His novels, *Nattevagt* (Night Vigil, 1894), *Den Gamle Adam* (1895), and *Hoejsang* (1896) are full of psychological, aesthetic and moral problems; and are somewhat autobiographical. His third great novel, *De doedes rigs.* (1912-16) covered the first decade of the 20th century and expressed dissatisfaction with the political development. The critical novel, *Mands Himmrig* (1927), described neutral Denmark during World War I and attacked carefree materialism.

His last important work was his memoir in four volumes published between 1933-40. It appeared later in a collected and abridged version called, *Undervejs till mig selv* (1943).

Note: The 1917 Prize in Literature was awarded jointly to Gjellerup and Pontoppidan.

Peace

COMITE INTERNATIONAL DE LA CROIX-ROUGE (INTERNATIONAL COMMITTEE OF THE RED CROSS)

Geneva

The only Nobel Prize awarded during World War I, did not go to any individual peace worker or a pacifist organization, but to the humanitarian institution, the *Comite International De La Croix-Rouge* (the International Committee of the Red Cross). This committee was a continuation of the *Societé Genevoise d' Utilite Publique* (Genevian Society of Public Utility).

It was the first organizational basis for Henri Dunant's idea of the international protection of the medical services in times of war. The committee set itself the task of implementing the Geneva Convention during peace and in war, in addition to stimulating the setting up of Red Cross Organizations all over the world. Its activity and its initiative throughout its existence have automatically given it a very real prestige and authority.

1918

PHYSICS

Planck, Max Karl Ernst Ludwig

CHEMISTRY

Haber, Fritz

1918

Physics

In recognition of the services he rendered to advancement of physics by his discovery of energy quanta.

Planck, Max Karl Ernst Ludwig, b.—April 23, 1858, Kiel, Schleswigholstein, d.—October 3, 1947, Göttingen, both in West Germany. He was the son of Julius Wilhelm Planck and Emma Patzig and he grew up in Munich where he pursued a wide range of cultural interests. Planck seriously thought of devoting himself to music, but instead chose a career in theoretical physics with encouragement from his professors at the University of Munich. Planck had a strong personality which, though conservative, was always tempered by humor and a sense of humanity. When Hitler rose to power, he opposed the Nazi regime and defended Jewish colleagues from persecution as best as he could.

Planck's career began at the University of Munich where he received a doctorate. In Berlin he studied under physicists Herman von Helmholtz and G.R. Kirchhoff. He taught theoretical physics in Munich, Kiel and Berlin.

Planck had spent several years studying the way in which heated bodies emit energy as radiation. He postulated that radiation consisted of tiny energy "particles" which he termed quanta. He applied this idea to the problem of heated bodies and immediately found an exact and straight forward description of the energy distribution. Planck reduced the problem to a simple relationship: the emitted energy is proportional to the wavelength of the radiation. He showed that energy and wavelength were linked by a special number that he named Planck's constant. It was soon to be discovered by scientists that this constant played an important role in basic laws governing some of the innermost mechanisms of nature.

In 1900 Planck formulated the correct mathematical description of thermal radiation from a perfect absorber and showed that the formulation required a discontinuous process of emission or absorption involving discrete quantities of energy. Quantum theory was not accepted at once, but it was seen that it explained observable facts. In 1913 the Danish physicist Niels Bohr applied quantum theory to ideas of atomic structure and achieved spectacular results. The new quantum model of the atom explained a wide range of atomic phenomena and was the starting point of a better understanding of the atom.

PLANCK, MAX KARL ERNST LUDWIG
Germany

Planck's theory provided the tool to explore the microworld of atoms which had seemed strange and unpredictable because of the unfamiliar and obscure laws governing it. The birth of quantum physics helped scientists to build up theories about the everyday world from a detailed and accurate knowledge of the subatomic world. Today, quantum physics is used by atomic scientists to refine their understanding of the tiniest particles in nature, those involved in the inner structure of the atomic nuclei. Astrophysicists use Planck's quantum theory to describe the behaviour of atoms and molecules in the huge accumulations that form stars and galaxies. In 1930, he became the President of Kaiser Wilhelm Society in Berlin, which came to be known as the Max Planck Society after World War II.

Planck was twice married. In 1885, he married his childhood friend Marie Merck, who died in 1909. He later married his cousin Marga von Hösslin. Three of his children died young, leaving him with two sons. One of them was executed for his part in an unsuccessful attempt on Hitler's life in 1944.

Chemistry

For the synthesis of ammonia from its elements.

Haber, Fritz, b.—December 9, 1868, Breslau, Silesia, now Wroclaw, Poland, d.—January 29, 1934, Basel, Switzerland. Fritz Haber was the only son of a prosperous chemical merchant and served in his father's firm for a very short time. After an indifferent university career, he took his doctorate in chemistry in 1891. He taught himself the then new subject of physical chemistry. He obtained a teaching post in physical chemistry at the *Techinsche Hochschule* of Karlsruhe in 1894. Simultaneously, he began work in thermodynamics and electrochemistry, for which he was awarded a Professorship. His studies led to the publication of a textbook in electrochemistry in 1905, *Thermodynamik techniseher Gasreaktionen.*

Sir William Crookes had pointed out the dangers of the exhaustion of nitrogen in the form of minerals such as Chilean nitrate deposits in the soil. As a means of increasing the availability of nitrogenous fertilizers, Haber considered the possibility of chemically fixing the large amount of nitrogen present in the atmosphere. He worked persistently for two years, 1907-9, and was able to demonstrate the reaction $N_2+3H_2 \rightleftharpoons 2NH_3$ was industrially practicable at a pressure of 150-200 atmosphere with a suitable catalyst. By 1913, Carl Bosch had succeeded in synthesizing ammonia on an industrial scale—this process came to be known as Haber-Bosch Process.

Haber held the Chair of Physical Chemistry at Karlsruhe from 1906 to 1911 and in 1912 he accepted the post of Director of the newly formed *Kaiser Wilhelm Institut für physikalische Chemie und Electrochemie* at Dahlem on the outskirts of Berlin. The outbreak of World War I saw Haber involved in the development of gas as a military weapon. After the war, his institute became the world's leading centre for research in physical chemistry. He took an active part in several major investigations, one such being the extraction of traces of gold from sea-water. In 1918 he received the prize for synthesizing ammonia. His colleague Carl Bosch received the prize in 1931 for developing techniques in high-pressure chemical processes.

HABER, FRITZ
Germany

Haber became an authoritative advocate of collaboration between science and industry. During the 1920s he built up his laboratory into probably the world's foremost unit for the study of physical chemistry and its application in industries. He attracted many scientists including a large number of foreigners who were later to enrich the physical sciences.

Haber's work at the institute and all his academic activities had to be given up in 1933 due to the anti-semetic policy of the Nazis. He accepted the hospitality of the Cavendish laboratory and spent the last few months of his life in Cambridge.

He died in Switzerland. He was a Rumford Medalist of the Royal Society and an honorary fellow of the Chemical Society of London.

1919

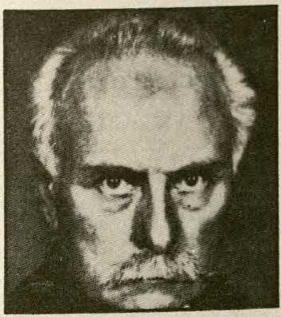
PHYSICS
Stark, Johannes
PHYSIOLOGY OR MEDICINE
Bordet, Jules-Jean-Baptiste-Vincent
LITERATURE
Spitteler, Carl Friedrich Georg
PEACE
Wilson, Thomas Woodrow

1919

Physics

For his discovery of the Doppler effect in canal rays and the splitting of spectral lines in electric fields.

Stark, Johannes, b.—April 15, 1874, Schickenhof, Bavaria, in Germany, d.—June 21, 1957, Trauenstein. Stark became a lecturer at the University of Göttingen in 1900 and from 1917 until his retirement in 1922 he served as professor of physics at the University of Greifswald and, later, at the University of Wuerzburg. He was a supporter of Hitler and an anti-semetic racial theorist. Stark was president of the Reich Physical-Technical Institute from 1933 to 1939. In 1947, a denazification court sentenced him to serve four years in a labour camp for his support and activation of Nazi policy.



STARK, JOHANNES
Germany

The prize enabled him to set up his own private laboratory, where, during the last years of his life, he investigated the effect of light deflection in an unhomogeneous electric field.

He married Luise Tiepler; they had five children.

Physiology or Medicine

For his discoveries relating to immunity.

BORDET, JULES
Belgium

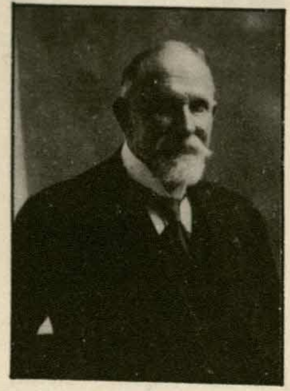
Bordet, Jules-Jean-Baptiste-Vincent, b.—June 13, 1870, Soignies, Belgium, d.—April 6, 1961, Brussels. A bacteriologist and immunologist, he received the prize for his discovery of immunity factors in blood serum; this was a development vital to the modern diagnosis and treatment of many dangerous contagious diseases.

His research on the destruction of bacteria and red corpuscles in blood serum, conducted at the Pasteur Institute, Paris, is generally believed to constitute the beginnings of serology. In 1895, he found that two components of serum are responsible for the rupture of bacterial cell walls; one is a heat-stable antibody, found only in animals already immune to the bacterium; the other is a heat-sensitive substance that is found in all animals and is now known as the complement.

Three years later, Bordet discovered that foreign red corpuscles were also ruptured in blood serum. This process, which he called 'haemolysis', was analogous to bacteriolysis and also required a complement.

In Brussels, where he founded and directed (1901-40) the Pasteur Institute of Brabant, Bordet continued his research on immunity with Octave Gengou. Their work provided the basis of serological tests for many disease organisms, including those of typhoid fever, tuberculosis, and, most notably, syphilis. After his discovery (with Gengou; 1906) of the bacterium responsible for whooping cough, now called *Bordetella pertussis*, Bordet became professor of bacteriology at the University of Brussels, where he studied blood coagulation and bacteriophages.

Literature



SPITTELER, CARL FRIEDRICH GEORG
Switzerland

In special appreciation of his epic, 'Olympian Spring'.

Spitteler, Carl Friedrich Georg, b.—April 24, 1845, Liestal near Basel, Switzerland, d.—December 28, 1924. He was born in a middle class Swiss family. During his childhood he had a liking for music and painting. During his stay in Basel he was much influenced by Wackernagel, the philologist, and by Burckhardt, the art historian. Burckhardt introduced him to the writings of Ludovico Ariosto. Those writings immensely influenced him and he began writing verses.

He studied law for two years during 1863-65 and for five years (1865-1870) he studied theology in the Zürich, Heidelberg and Basle universities. He then went on a sojourn to Russia where he became the private tutor to the children of a General. In 1879, he returned to Switzerland and worked for some time as teacher in a girls' school in a small town in the Bern canton.

The teaching job did not satisfy him, so he left it abruptly, took to journalism and began freelance writing for the *Grenzepost* (Basel) and the *Neue Zuercher Zeitung* (Zurich). In 1891, he gave up journalism. While he was tutoring in Russia he wrote his famous poem *Prometheus und Eipmetheus* (1881) and first published it under the pen-name of "Carl Felix Tenden", but ten years later he republished the same under his real identity. He published *History of Creation* in 1883 and *Schmetterlinge* (Butterflies) in 1889.

His magnum opus, *Olympischer Fruehling* (Olympian Spring), was published between 1900 and 1906. It was in four parts, *Overture, Hera the Bride, High tide* and *End and Change.* The first two parts remained almost unnoticed until one German musician named Felix Weingaertner brought out a small book entitled, *Carl Spitteler, ein Kuensterliches Erlebnis* (1904). It contained the first two parts of *Olympian Spring* and *Prometheus.* The effect was almost immediate, he became famous all over Europe. In 1924, Spitteler wrote a complementary sequel to *Prometheus* entitled *Prometheus des Dulder* (Prometheus, the Sufferer). Two weeks after its completion, Spitteler died, just as Goethe had, after completing his second *Faust.*

Peace

WILSON, THOMAS WOODROW
USA

Wilson, Thomas Woodrow, (1855-1924). The Peace Prize distribution during Wilson's time had a peculiar character all its own, as the recipients were people who played a leading part in the creation of the League of Nations. There can hardly be any doubt that Woodrow Wilson was the central figure among all the prize-winners, though it was not until late in his career that he devoted his energies to the actual problem of peace.

There was no doubt that Wilson's ideas were essentially different from Roosevelt's and that he regarded the American participation in the war as a necessity in order to safeguard the future of democracy. In fact, Wilson regarded the establishment of League of Nations as a major peace project. Primarily, he had aimed at maintaining the neutrality of the United States, and on that basis he was re-elected President in 1916. Wilson retained this basic idea in his attitude to the peace settlement. Peace would have to be established on a universal foundation and must ensure the right of every country for self-determination. The terms of the Versailles Treaty would undoubtedly have been stricter if Wilson had not been one of its sponsors. Wilson received invaluable support from Lord Robert Cecil of Chelwood (1864-1958) who was also awarded the prize in 1937.

1920

PHYSICS
Guillaume, Charles Edouard

CHEMISTRY
Nernst, Walther Hermann

PHYSIOLOGY OR MEDICINE
Krogh, Schack August Steenberger

LITERATURE
Hamsun, Knut Pedersen

PEACE
Bourgeois, Leon Victor Auguste

1920

Physics

In recognition of the service he has rendered to precision measurements in Physics by his discovery of anomalies in nickel steel alloys.

Guillaume, Charles Edouard, b.—February 15, 1861, Fleurier, Switzerland, d.—June 13, 1938, Sevres, France. Guillaume was the son of a watchmaker and received his early education in Neuchatel before going to the Zürich Polytechnic in 1878 where he obtained his doctorate. He joined the army as an artillery officer and during his brief military career studied mechanics and ballistics.

GUILLAUME, CHARLES EDOUARD
Switzerland

In 1883, Guillaume joined the International Bureau of Weights and Measures in Sevres, and from 1915 until his retirement in 1936 served as its director. His early studies there included investigations on the mercury thermometer and of the volume of the litre, which he found to be 1,000,028 cubic centimetres, not 1,000,000 cubic centimetres as had been accepted universally. He focussed his attention on alloys and his exhaustive studies of ferronickel alloys culminated in the discovery of "invar" (a nickel-steel alloy), which gained him the prize. Invar's low coefficient of expansion and elinvar's low coefficient of elasticity combined with their low cost resulted in their widespread use in scientific instruments.

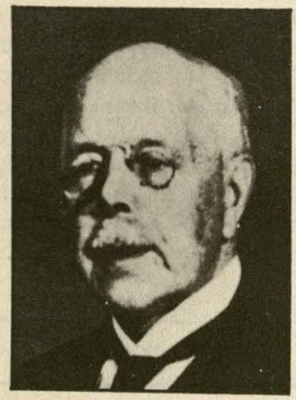
He married Mlle. A.M. Taufflieb in 1888; they had three children.

Chemistry

In recognition of his work in thermochemistry.

Nernst, Walther Hermann, b.—June 25, 1864, Briessen, Prussia now in East Germany, d.—November 18, 1941, Muskau, East Germany. The son of a civil servant, Nernst studied science at the universities of Zürich, Würzburg and Graz. He became an assistant to Ostwald (Nobel Laureate) who, with Vant Hoff and Arrhenius (both Nobel Laureates), established the original identity of physical chemistry. In 1894, he became the first Professor of Physical Chemistry at Göttingen. He succeeded H.H. Landolt as Professor of Physical Chemistry at Berlin in 1904 where apart from active service during the war, he worked until 1922, being Rector of the university in his last years. He retired in 1933 having fallen out of favour with the Nazis. He spent the remaining years of his life in his country home, in farming, fishing, and administration of his estate.

Nernst derived an expression connecting ionic mobilities and temperature with the potential difference between solutions in contact. He devised methods for measuring dielectric constants, degree of ionic hydration, and pH by indicators. He developed the idea of solubility product and, in 1903, suggested the use of buffer solutions. His theories of galvanism, based upon the concept of electrolitic solution pressure and the associated equations, are still basic to electro-chemistry today. Nernst also developed theories on decomposition and contact potentials, the behaviour of palladium electrodes and nerve stimulation. He introduced a method for determining the ionic product of water and was the first to advocate the hydrogen electrode as an electrochemical standard.



NERNST, WALTHER HERMANN
Germany

In 1905-6, Nerst formulated the Third Law of Thermodynamics, which was essentially a derivation from the Helmholtz Equation and the Thomson-Berthelot principle of maximum work. The theorem was first used chiefly in the study of chemical equilibria, but later became connected with quantum theory and statistical mechanics. In 1911, he devised a special calorimeter for determination of specific heat at low temperatures and these results led to significant advances in the quantum theory of specific heats.

Nernst's research concerning the theory of galvanic cells, the thermodynamics of chemical equilibrium, the properties of vapours at high temperature and of solids at low temperature, and the mechanism of photochemistry have found important applications in industry and science.

Nernst was also interested in applied science. He invented and improved electric light and an electronically amplified piano. His famous textbook of *Theoretical Chemistry* was first published in 1893. Towards the later part of his life, he studied astrophysics.

He was elected a Foreign Member of the Royal Society in 1932.

Physiology or Medicine

For his discovery of the capillary motor regulating mechanism.

Krogh, Schack August Steenberger, b.—November 15, 1874, Grenna, Denmark, d.—September 13, 1949, Copenhagen. Krogh was the son of a shipbuilder and brewer, and loved the sea. He joined the Danish navy and after his first cruise went back to school at Aurbus. He joined the University of Copenhagen to study physics, but changed to zoology in which he graduated in 1899 and obtained his doctorate four years later. He specialized in marine biology. Krogh's doctoral thesis was on the respiration of frogs. In 1902, he went on a scientific expedition to Greenland to study the metabolism of Arctic animals. He was awarded a prize in 1906 by the Vienna Academy of Science for investigations described in his treatise *Mechanism of Gas Exchange in Lungs.* He made a second expedition to Greenland in 1908 accompanied by his wife, the scientist Marie Krogh, to study metabolism in relation to nutrition of the Eskimoes. He became lecturer in zoology and physiology in the University of Copenhagen the same year. In 1910, he became a professor and held the post until his retirement in 1945.

KROGH, SCHACK AUGUST STEENBERGER
Denmark

Krogh's work on the physiology of respiration and the distribution of blood to the tissues is of significance. In 1904, he discovered that the dissociation curve of haemoglobin is greatly influenced by the partial pressure of carbon dioxide. As the blood takes up carbon dioxide in the capillaries, there is an increased liberation of oxygen from oxyhaemoglobin. For the easy determination of gaseous exchange between a single bubble of air and blood flowing round it, Krogh in 1908 developed the micro-acrotonometer. With the help of this instrument Krogh and his wife were able to show that arterial oxygen pressures were always below the oxygen pressures in the alveolar air, and said that gaseous exchange in the lungs is always due to diffusion. He calculated the quantity of oxygen which should theoretically diffuse across the walls of the pulmonary alveoli, and showed that this amount was equal to the exchange of gas actually found and this was applicable to conditions with extreme demand for oxygen. Krogh and Johannes Lindhard in 1912 worked out the nitious method measuring the circulation rate in man.

Krogh's next work was on capillaries. He found that the capillaries contract or dilate in proportion to the tissues requirement for blood. Active muscles for example have a greater number of open capillaries than the dormant ones. His study of the circulatory mechanism that control the supply of oxygen to the tissues developed in relation to his primary interest in respiration, a subject in which he collaborated with his wife, Marie. He showed the oxygen tension in muscle is only slightly below that in the capillaries, even when the muscle is intensely active. He found that when a muscle is at rest the number of capillaries seen is relatively less. But the stimulation of a muscle results in the opening of many other capillaries which become filled with blood, and then disappear when the muscle rests.

Krogh showed that the above effects are not due to increased pressure in the vessel supplying the capillaries, but a demand for more blood to the part as a result of the stimulation of the muscle, due to which the capillaries open and get filled with blood.

He became a Foreign Member of the Royal Society in 1937. In 1945 he was awarded the Baly Medal of the Royal College of Physicians of London. He was bestowed honorary doctorates by eight foreign universities.

Literature

For his monumental work, 'Growth of the Soil'.

Humsun, Knut Pedersen, pseudonym **Knud Pederson,** b.—August 4, 1859, Lom, Gudbrandsdalen, Norway, d.—February 19, 1952, near Crimstad. A novelist, dramatist, poet and a leader of the Neo-Romantic revolt at the turn of the century, he was the son of a peasant and spent most of childhood in the remote Lofoten Islands and had almost no school education.

He started writing at the age of 19 when he worked as a shoemaker's apprentice at Bodoe in northern Norway. During the next 10 years, he lived in almost extreme poverty as a casual labourer. Twice he visited USA where he worked as a tram conductor in Chicago and as a farm labourer in North Dakota.

HAMSUN, KNUT PEDERSEN
Norway

He entered the literary world at the age of 31 with the publication of his novel *Sult*, 1890 (Hunger, 1890). It is the story of a starving young writer in Norway. He stressed on the strange fancies, nuances of feeling, and irrational acts of its hero rather than on his environment. "Hunger" made a clear departure from the social realism of the typical Norwegian contemporary novel. Its refreshing viewpoint and lyrical style had a profound effect on European readers and writers.

His other works include *Mysterier* (1892, Mysteries), *Ny jord* (New Earth, 1893), *Pan* (1894), *Victoria* (1898), *Svaermere* (Dreamers, 1904), *Rosa* (1908), *Benoni* (1908), *Boern af Tiden* (Children of the Age, 1913) and *Segelfloss By*

(Segelfloss Town, 1916). *Markens groede* (1917, Growth of the Soil, 1920) was in his natural style through which he expressed a "back to the nature" philosophy. His later novels include *Konerne ved Vandposten* (The Women at the Pump, 1921), *Siste Kapitel* (The Last Chapter, 1923), *August* trilogy (1927-33) and *Ringen Sluttet* (The Ring is Closed, 1936), his last novel.

His deliberate irrationalism and his wayward impressionistic style had wide influence throughout Europe, and such writers as Maxim Gorky, Thomas Mann and Isaac Bashevis Singer acknowledged him as a master novelist. He supported the Germans during their occupation of Norway in World War II.

After the war he was indicted as a quisling, but the charges were dropped because of his age. The collaboration with the Nazis seriously damaged his reputation, but after his death critical interest was revived and newer translations of his works were published.

Peace

Bourgeois, Leon Victor Auguste, b.—May 21, 1851, Paris, d.—September 29, 1925, Chateau d'Ogen, France. A French politician, statesman and an ardent promoter of the League of Nations. Trained in Law, Bourgeois entered the French civil service in 1876 and by 1887 had risen to the position of prefect of police for the Seine department. In 1888, he was elected to the National Assembly as a deputy from the Marné district. After serving in a number of ministerial posts, he became the premier. Later, he was the head of the Radical-Socialist Party. He represented the Marné district in the Senate and was its President from 1920 to 1923. Bourgeois was a French delegate to The Hague Conference of 1899, where he promoted international cooperation among nations. In 1903, he was appointed to the International Court of Justice. He was instrumental in formulating the 1906 agreements on Moroccan independence. In 1919, he was France's representative to the League of Nations, emerging as its champion. He was known as a leading spokesman for the social theory of solidarism, which stressed the quasicontractual nature of society and the essential obligations of all men to it. His publications include *Solidarité* (1896), *La Politiqué de la prevoyance sociale* (2 vols, 1914-19), *Le Pacte de 1919 el là Societé des Nations* (1919), and *L'Oeuvré de la Societé des Nations* (1920-23).

BOURGEOIS, LEON VICTOR AUGUSTE
France

1921

PHYSICS
Einstein, Albert
CHEMISTRY
Soddy, Frederick
LITERATURE
Anatole France
PEACE
Lange, Christian Lous
Branting, Karl Hjalmar

1921

Physics

For his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect.

Einstein, Albert, b.—March 14, 1879, Ulm, Württemberg, Germany, d.—April 18, 1955, Princeton, New Jersey. Einstein's father was a chemical engineer whose business demanded moving frequently which resulted in irregular education for his son. Einstein showed little intellectual promise in his early school days and entered *Eidgenossische Technische Hochschule* in Zuerich at 17 and completed his education in 1901. Although a Swiss citizen he was unable to get the post of a school teacher since he was a Jew. He found employment in the Patents Office in Berne as a junior clerk and finding the work undemanding, he devoted most of his spare time to research. He made his first contribution to theoretical physics in 1901 and got his doctorate from the Polytechnic Academy in Zuerich in 1905. The same year he published three papers each containing a great discovery in physics. His paper which dealt with the Brownian movement, that is, the irregular movements of tiny particles due to bombardment by molecules, showed that, by making measurements of the movement of visible particles, the molecules of liquid per unit volume could be deducted. His paper on quantum mechanics proved that radiation consisted of particles (photons) each carrying a discrete amount of energy. His paper which he called "The Special Theory of Relativity" challenged the views of time and space that were accepted since Newton's day. It was believed for centuries that mass, length and time were absolute and unvarying. Einstein had spent many years trying to measure light. Repeated failures of the Michelson-Morley experiments to measure the speed of light in 1887 led to the conclusion that the velocity of light in vacuuo was constant. Drawing directly from these conclusions, Einstein derived his famous equation $E=mc^2$ which was to form the basis of atomic energy.

EINSTEIN, ALBERT
Germany/USA

After teaching in the University of Berne, he became Professor in Zuerich in 1909 and then in German University of Prague in 1910 and in the E.T.H. Zuerich in 1912. In 1913 he settled in Berlin as a member of the Royal Academy of Sciences, where he remained for 20 years.

In 1915, his General Theory of Relativity gave a mathematical description of the structure of space. He suggested that the universe consisted of a continuum of space and time in the form of a complicated four-dimensional curve and, therefore, gravity was actually created by localized bending in the fabric of space by the presence of large masses such as stars and planets. This required that light, like material bodies, should also be affected. His theory created a raging controversy among scientists since it challenged Newtonian physics and the assumption that acceleration produced in a body by gravitation was independent of its mass. Proof of his predictions came in 1919 and created a sensation. Einstein had predicted that light rays passing near the sun would be bent out of their path by twice the amount that the Newtonian laws accounted for because of the gravitational field. This was borne out by detailed studies on the photographs taken during solar eclipse. Einstein had caused the greatest revolution in scientific thinking since Isaac Newton.

While teaching at the Berlin University, he travelled widely in Europe and the United States on lecture tours speaking not only on his work but on social and political issues also. Being a shy man, the glare of publicity embarrassed him, but he used his status to fight the rise of the Nazis in Germany and to support the establishment of Palestine as a homeland for Jews. In 1933 when Nazis came to power, while Einstein was on a lecture tour abroad, the Germans confiscated his property and took away his citizenship. He was welcomed by the United States where he joined the Institute for Advanced Studies, Princeton, New Jersey. Here he worked for the rest of his life.

Einstein was deadly against proliferation and stockpiling of nuclear weapons. He backed the pacifist movement and other humanitarian causes. He had deep love for music which he developed in his childhood remained with him to rest of his life.

Einstein was married twice. In 1901 he married Mileva Maritsch and they had two sons. Their marriage was dissolved and in 1917 he married his cousin Elsa Einstein who died in 1936.

Chemistry

For his contributions to our knowledge of the chemistry of radioactive substances, and his investigations into the origin and nature of isotopes.

Soddy, Frederick, b.—September 2, 1877 Eastbourne, Sussex, d.—September 22, 1956, Brighton. He was educated in Wales and at Oxford. Soddy headed the honours list in chemistry at Oxford with Sir William Ramsay (Nobel Laureate) as his external examiner. He worked with Ramsay at University College, London, and was associated with him in the classic experiment which identified the gaseous product of radioactive decay of radium with helium. Soddy worked under the Nobel Laureate Sir Ernest Rutherford at McGill University, Montreal (1900-02). In 1904 he was appointed lecturer in Physical Chemistry at Glasgow. He held teaching positions in Scotland and was Dr. Lees Professor of Chemistry at Oxford during 1919-36.

SODDY, FREDERICK
Great Britain

From his work with Rutherford on the disintegration of radioactive elements, Soddy concluded in 1912 that certain elements might exist in forms that differ in atomic weight, while being indistinguishable and inseparable chemically. He coined the name "isotope" for these elements, because they occupy the same place in the Periodic Table of the elements.

Soddy strongly believed that his work was not rightly acknowledged by the world. His election as Fellow of the Royal Society at the age of 33 and the award of the prize completely belied his belief. However, he increasingly turned to politics and economics, and resigned his post as Professor at Oxford in 1936.

Literature

In recognition of his brilliant literary achievements, characterized as they are by a nobility of style, a profound human sympathy, grace, and a true Gallic temperament.

Anatole France, b.—April 16, 1844, Paris d.—October 12, 1924, St. Cyr-Sue-Loire. A writer considered in his day as the most ideal French man of letters. He was a refined artist, an ironic, a skeptic, an urban critic and a highly civilized man. He was the son of a bookseller and spent most of his life amidst books.

At school he received training in culture and decided to devote his life to literature. He was influenced by the Paranassian revivalist thoughts of classical tradition and his initial writings were influenced by them. His ideological skepticism was obvious in his writings: *Le Crime de Sylvester Bernard* (1901), it is the story of a devoted philologist in love with his subject but otherwise awkward in everyday life, *La Rotisserie de la Reine Pedauque* (1895, The Sign of the Reine Pedauque, 1913), a book mocking occult human beliefs, and *Les Opinions de M. Jerome Coignard* (1893), a novel in which an ironic critic scrutinizes the renowned state institutions of France. His love affair with Caillavet in 1883 engendered his novel *Thais* (1890, English, 1909) and *Le Lys rouge* (1894, The Red Life, 1908), a love story set in Florence.

ANATOLE FRANCE (Pen-name of THIBAULT JACQUES ANATOLE)
France

His style of writing and thought changed in his writings: *Historie contemporaine* (vols, 1897-1900). The first three volumes, *L'Orme due mail* (1897, The Elm Tree on the Mall, 1910), *Le Mannequin d' osier* (1897, The Wickerwork Woman, 1910) and *L'Anneau d' amethyste* (1899, The Amethyst Ring, 1919) depict the intrigues in a provincial urban society. The last volume *Monsiur Bergeret a Paris* (1900, Monsiur Bergeret in Paris, 1921) describes the participation of the main character of the novel in the scandalous Dreyfus Affair. His social preoccupations were introduced through *L'Affaire Crainquebille* (1901, English, Crainquebille, 1915).

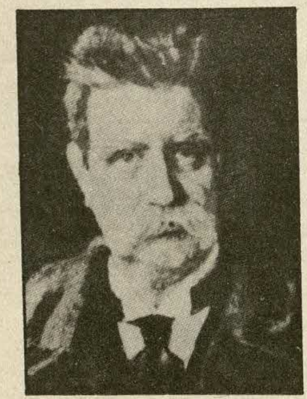
His other works include *L'Ile des Pingouins* (1908, Penguin Island, 1909), *Les Dieux ont soif* (1912, The Gods are Athirst, 1913), *La Revolte des anges* (Revolt of the Angels, 1914), *Le Petit Pierre* (1918, Little Pierre, 1920), *La Vie en fleur* (1922, The Bloom of Life, 1923) and *Le Livre de mon ami* (1885, My Friends' Book, 1913).

Peace

LANGE, CHRISTIAN LOUS
Norway

Lange, Christian Lous, b.—September 17, 1869, Stavanger, Norway, d.—December 11, 1938, Oslo. An ardent advocate of International Peace and Secretary General of the Inter-Parliamentary Union. Lange graduated in linguistics from the University of Oslo, and received a doctorate for a thesis on the history of internationalism. He served as Secretary to the Nobel-Committee in Oslo and was instrumental in organizing the library of the Nobel Institute. In 1907, he was a delegate to the Second Peace Conference at The Hague. Under his secretary generalship of the *Union Interparlementairé* (Inter-Parliamentary Union) an international convocation of parliamentarians founded by Sir William Randal Cremer (the recipient of the Nobel Peace Prize in 1903) prospered. For these services, Lange shared the prize with the Swedish statesman Karl Hjalmar Branting. Lange was also active in the activities of the League of Nations as its Norwegian delegate. He was keenly interested in disarmament.

Branting, Karl Hjalmar, b.—November 23, 1860, Stockholm, d.—February 24, 1925, Stockholm. A statesman and pioneer of social democracy whose conciliatory international diplomacy in the first two decades of the 20th century was recognized by the award of the Peace Prize.



BRANTING, KARL HJALMAR
Sweden

After studying science in Stockholm and Uppsala, Branting began work for the radical newspaper *Tiden,* becoming its editor shortly thereafter. In 1886, he assumed the editorship of the *Social-Demokraten,* and when the Social Democratic Party was formed in 1889 he was prominent among its founders. Elected to the lower chamber of the *Riksdag* (Parliament) for the first time in 1896, he was until 1902 its only Social Democratic member. After the unilateral withdrawal of Norway from union with Sweden in 1905, Branting with other Socialists and Liberals played an important part in quietening Swedish revengeful attitude.

He became leader of his party, mobilizing the working classes in support of the demand for adult, equal, and direct suffrage but at the same time facilitating cooperation with progressive liberal elements. This tactic resulted in the Liberal-Socialist coalition government of 1917 in which he was the minister of finance, and initiated constitutional reform of 1918 that facilitated the spread of social democracy throughout Sweden. An advocate of Swedish neutrality during World War I, he was a delegate to the Paris Peace conference and to the London discussions on the future of the Aland Islands, over which Sweden was in conflict with Finland. He was also the first Swedish representative to the League of Nations and Chairman of the Bern conference of the Second International. In March 1920, Branting formed Sweden's first Social Democratic government, but election held the following September went against him. He returned to power in September 1921. He retained his office until April 1923. In October 1924, he formed a third government, but illness led to his resignation.

Note: The 1921 prize was divided equally between Lange and Branting.

1922

PHYSICS
Bohr, Niels
CHEMISTRY
Aston, Francis William
PHYSIOLOGY OR MEDICINE
Hill, Sir Archibald Vivian
Meyerhof, Otto Fritz
LITERATURE
Benavente, Jacinto
PEACE
Nansen, Fridtjof

1922

Physics

For his services in the investigation of the structure of atoms and of the radiation emanating from them.

Bohr, Niels, b.—October 7, 1885, Copenhagen, d.—November 18, 1962, Copenhagen. Bohr was the son of a physiology professor and grew up in an atmosphere of learning. With all his interest in an academic career, he found time for outdoor activities. He was an excellent soccer player and took a keen interest in sports throughout his life. He obtained his doctorate in theoretical physics from the University of Copenhagen in 1911 and was a research scholar in Cambridge University for the next five years. It was there under the influence of the great Ernest Rutherford that he became interested in the structure of the atom. Bohr worked briefly as a lecturer in Manchester, England. During World War II he also lived as an expatriate in foreign countries as he was an ethnic Jew.

BOHR, NIELS
Denmark

Bohr was impressed by Rutherford's structure of the atom—a kind of a miniature solar system with the negatively charged electrons orbiting round the positively charged nucleus. According to the laws of physics, electrically charged particles moving in circles should emit electro-magnetic radiation, lose energy and spiral inward to the centre. To accept Rutherford's solar system model, a new mechanism for the emission of energy by electrons had to be worked out.

Bohr took hydrogen as his example since it was the simplest atom known. It has a single positive charge on its nucleus and a solitary electron orbiting round it. Bohr stressed that as long as the atom was in its lowest energy state—"ground state"—the electron would not emit energy and could therefore continue orbiting the nucleus indefinitely. The electron could, however, occupy any of the several possible orbits, each representing a different energy level in the atom. If energy was fed into the atom, the electron could "jump up" to an orbit of higher energy than the ground state. If it is left to itself, the electron would jump back down the energy levels until it reached the ground state again. While doing this it would shed energy, mainly as light in packets or quanta (Max Planck's quantum theory). The size of the quanta and hence the wavelength of the light would depend on the differences in the levels of energy through which the electron had jumped back in stages to the ground level.

Bohr's concept of specific energy levels within the atom is today a cornerstone of atomic theory. He is regarded as one of the founders of modern atomic theory.

In 1940 when the Nazis invaded Denmark, Bohr's fame became a threat to his freedom. The atomic research efforts of Hitler's Third Reich considered him a positive asset of great value. Like many of his countrymen, Bohr also loathed the Nazis and what they stood for. By defying them he repeatedly risked arrest and imprisonment. When in 1943 he was sure he could no longer avoid being arrested, he decided to flee to Sweden. He valued his Nobel medal so much that he was not willing to risk it. He, therefore, dissolved it in a bottle of acid and hid it safely in his apartment. Years later he returned to his homeland, reclaimed the gold from the acid and had the medal recast.

Bohr married Margrethe Norlund in 1912 who was for him an ideal companion. They had six sons but lost two. Their four sons have made distinguished careers in various professions.

Son Aage Bohr was awarded the Nobel Prize for Physics in 1975.

Chemistry

For his discovery, by means of his mass spectrograph, of isotopes in a large number of non-radioactive elements, and for his enunciation of the whole-number rule.

Aston, Francis William, b.—September 1, 1877, Harborne, Birmingham, England, d.—November 20, 1945, Cambridge. Aston was the third child of a family of seven children. He was educated at Harborne Vicarage School, and Malvern College. In 1894, he joined Masan College, Birmingham, which later came to be known as the University of Birmingham, and studied chemistry and physics. In 1898, with the help of a Forestor scholarship, he began work on the optical properties of tartaric acid derivatives, the results of which were published in 1901. For the next three years he worked as a chemist in the laboratory of a brewery, during which time he developed an interest in physics.

Aston went to the University of Birmingham in 1903 on a scholarship to work on the properties of the Crookes Dark space in discharge tubes, and discovered within a short time, the phenomenon now known as Aston Dark space. In 1910, he became an assistant to the English Nobel Laureate Sir Joseph John Thomson at the University of Cambridge in the Cavendish Laboratory. It was during this period that he obtained definite evidence for the existence of two isotopes of the inert gas, neon.

During World War I, Aston worked on the effect of atmospheric conditions on aeroplane fabrics and synthetic coatings at the Royal Aircraft Establishment, Farnborough.

ASTON, FRANCIS WILLIAM
Great Britain

Aston returned to Cambridge after the war, and set out to attack the problem of the separation of the isotopes of neon. He constructed a new type of positive ray apparatus, which he named the *mass spectrograph*, in which the ingenious use of electromagnetic focusing enabled him to utilize the very slight differences in mass of the two isotopes to effect their separation. Extending this principle to other elements, he could show that not only neon, but also many other elements are mixtures of isotopes. Aston's achievement is illustrated by the fact that he discovered 212 of the 287 naturally occurring isotopes. He calculated the atomic weights of the elements from their isotopic masses and formulated the so-called Whole Number Rule, which states that, "the mass of oxygen isotope being defined, all other isotopes have masses which are very nearly whole numbers."

Aston continued his studies using an improvised instrument, and succeeded in determining precise and refined results. He was able to measure those deviations from the whole number rule which were to become very important in the field of atomic energy. These masses are fundamental to nuclear theory, and in the mid-20th century there were few areas of research in physics that did not depend on his work. His discoveries are of fundamental importance for the study of nature in general and for chemical science in particular.

Aston's work was published in the *Proceedings of the Royal Society* and the *Philosophical Magazine*. His other publications include *Isotopes* (1922, revised edition 1941) and *Structural Units of the Material Universe* (1923).

Aston was elected Fellow of Trinity College in 1920, Fellow of the Royal Society in 1921. In 1920 he received the Mackenzie Davidson Medal of the Röntgen Society and the Hughes Medal of the Royal Society in 1922. He received the John Scott and the Peterno medals in 1923, the Royal Medal in 1938, and the Duddell Medal of the Physical Society in 1941. He was an honorary member of the Academy of Sciences of the Soviet Russia, and of the *Academia die Lincei;* he held honorary doctorate of the universities of Birmingham and Dublin.

Aston's recreations were skiing, rock climbing, tennis and swimming. He was a keen musician, playing the piano, violin and cello. He was a bachelor.

Physiology or Medicine

For his discovery relating to the production of heat in the muscle.

Hill, Sir Archibald Vivian, b.—September 26, 1886, Bristol, Gloucestershire; d.—June 3, 1977, Cambridge. Hill went to Blundell's School at Tiverton, Devon, and in 1905 proceeded as a scholar to Trinity College, Cambridge. He took mathematics, finishing as Third Wrangler in 1907. Under the influence of W.M. Fletcher his interests changed to physiology and he took a first in Part II of the Natural Sciences Tripos in 1909. He then joined the Physiological Laboratory under J.N. Langley and after a brief period of important theoretical and experimental work on drug and enzyme kinetics began to develop methods for the study of mechanical and thermal energy exchanges during muscular contraction and their relation to the chemical process in muscle tissue. This work was interrupted by World War I, during which Hill served in the Army as a Major, founding and directing an Anti-aircraft Experimental Section.

In 1919, on his return to the Cambridge University, Hill began his investigations on the physiological thermodynamics of muscle and nerve tissue. Working with a straplike thigh muscle of the frog, he was able to demonstrate that oxygen is needed only for the recovery and not for the contractile phase of muscular activity. He laid the foundation for the discovery of the series of biochemical reactions carried out in muscle cells that result in contraction.

HILL, Sir ARCHIBALD VIVIAN
Great Britain

Hill was one of the great scientific leaders of his generation. He is remembered by many colleagues, including more than hundred personal pupils for his great scientific discoveries, leadership and humane qualities. In 1935 he was one of the three members of Tizard Committee who initiated radar for the defence of Britain. During World War II, he became an independent member of Parliament for Cambridge University. He had helped to establish scientific liaison between Britain, Canada and the United States. He joined the new Scientific Advisory Committee to the Cabinet in his capacity as Biological Secretary of the Royal Society. In 1943-44 he paid an important visit to India and advised the Indian Government on vital matters of scientific and medical postwar reconstruction. In his lecture as President of the British Association in 1952, he pointed very lucidly to the scientific and ethical problems of over-population, much before wide popular interest became focussed on it.

As Professor of Physiology at the Manchester University, and at the University of London, Hill served as Foulerton Research Professor for the Royal Society from 1926 until his retirement in 1951. He derived a mathematical expression known as "Hill equation" for the uptake of oxygen by haemoglobin. His works include *Muscular Activity* (1926), *Muscular Movement in Man* (1927) and *Living Machinery* (1927).

In appreciation of his work Hill received a number of scientific and public honours in his own country as well as abroad. He was awarded the Copley Medal of the Royal Society in 1918, to which he was elected in 1918, the Companion of Honours in 1946, the USA Medal of Freedom in 1947, Chevalier of the *Legion d' Honneur* in 1950, and a number of honorary degrees and academic memberships.

Hill was married to Margaret, the sister of John Maynard Keynes. He settled in Cambridge in 1967, where he continued to write on scientific and general subjects.

◆

For his discovery of the fixed relationship between the consumption of oxygen and the metabolism of lactic acid in the muscle.

Meyerhof, Otto Fritz, b.—April 13, 1884, Hanover now in West Germany, d.—October 6, 1951, Philadelphia. A biochemist who shared the prize with Archibald Vivian Hill for his work on the chemical reactions during muscle contractions.

MEYERHOF, OTTO FRITZ
Germany

His work is a basic contribution to the understanding of muscular action. After receiving his M.D from the University of Heidelberg in 1909, Meyerhof held posts in physiology and physical chemistry at Kiel and other noted German universities. From 1929 to 1938 he was head of the department of physiology at the Kaiser Wilhelm Institute for Medical Research at Heidelberg. After living for two years in Paris he served as research professor at the University of Pennsylvania, USA. He lectured widely in England and USA and wrote *The Chemical Dynamics of Living Matter* (1924) and *Contribution to Psychological Theory of Mental Diseases*. He also wrote an interesting essay entitled "Goethe's Methods in Natural Philosophy".

Meyerhof was the first to prove how the aerobic metabolic processes in the body, that is, those requiring the presence of oxygen, and the anaerobic processes, requiring no oxygen are linked. On sudden activity, he showed, the muscle always derives its energy from the anaerobic processes which is constantly available. This represents a waste of initial material because the process is not very rich in energy; however, the organism recombines the decomposition products again to form the original compounds, with the aid of oxygen. The ratio of anaerobic decomposition to aerobic recombination is known today as 'Meyerhof quotient.'

Otto Meyerhof was not only a clever and skilful experimenter, but also had philosophic and artistic interests. He obtained a doctor's degree in philosophy with an epistomological practise. As his pupil Herman Weber expressed, his scientific success sprang "from the well founded, consistent view of life of a man who possessed the highest, harmonious human qualities and moral calibre".

Note: The 1923 prize was divided equally between Hill and Meyerhof.

Literature

For the happy manner in which he has continued the illustrious traditions of the Spanish drama.

Benavente, Jacinto, b.—August 12, 1866, Madrid, d.—July 14, 1954, Madrid. He was one of the foremost Spanish dramatists of the 20th century.

His dramas were full of social criticism. He wrote a vast number of plays, starting with *El nido ajeno* (Another's Nest, 1894), *Gente Conocide* (High Society, 1896), an adaptation of Moliere's *Don Juan,* and *La Farandula* (The Company of Comedians, 1897). *Los intereses* *creados* (1907, The Bonds of Interest) was one of his most celebrated works based on Italian masked comedy. His other works include *Los malhechores del bion* (1905, The Evil Doers of God) and *La noche del Sabado* (The Saturday Night). *La malguerida* (1913), a rural tragedy with incest as its theme, was very successful in Spain and South America. *Senora Ama* (1908) is said to be his own favourite play, which was followed by *La Comida de las fieras* (The Wild Beasts' Medal, 1913).

BENAVENTE, JACINTO
Spain

In 1928 his play *Para el cielo y los altares* (Heaven and the Altars, 1928) prophesied the fall of the monarchy in Spain, so it was prohibited by the state for public performance. During the Civil War he lived in Barcelona and Valencia and was incarcerated for a while. He gained public favour again in 1941 with *Lo increible.*

He wrote more than 150 plays, an all-time record. He wrote harsh tragedies like *La Infanzona* (1948) and *El Lebrel del cielo* (1952). Quite a number of his dramas have been translated into English.

Peace

Nansen, Fridtjof, b.—1861, Norway, d.—1930. The negative forces within the League of Nations which barred the way to disarmament plans were on the whole equally active in the case of the relief work conducted by Fridtjof Nansen (1861-1930). Nansen's world fame was a direct result of his bold and epoch-making voyages of discovery to the Arctic. Politically, he was firmly rooted in liberalism. He had a great respect for human values, based on his scientific philosophy of life. During the war years Nansen worked energetically to achieve the setting up of an international organization; he was an ardent spokesman for the idea of a League of Nations, and spent the first half of the year 1919 in Paris in order to bring his influence to bear on the leading statesmen, so as to ensure a constructive peace settlement. Later on he played an outstanding role in the sessions of the League of Nations in his capacity as a member of the Norwegian delegation. He was given his first humanitarian task in 1920, to organize the return of the prisoners of World War I. It was his idea to issue passports to stateless persons. The passport is popularly known as "Nansen Passport"

NANSEN, FRIDTJOF
Norway

Nansen continued his international work right up to the time of his death. He is also famous for his organization of the transfer of populations which took place between Turkey and Greece.

1923

PHYSICS

Millikan, Robert Andrews

CHEMISTRY

Pregl, Fritz

PHYSIOLOGY OR MEDICINE

Banting, Frederick Grant
Macleod, John James Richard

LITERATURE

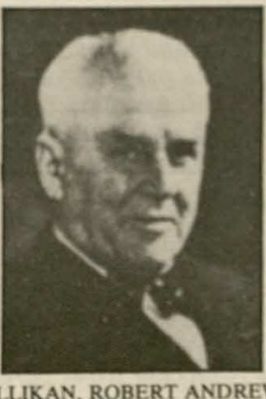
Yeats, William Butler

1923

Physics

For his work on the elementary charge of electricity and on the photoelectric effect.

Millikan, Robert Andrews, b.—March 22, 1868, Morrison, Illinois, d.—December 19, 1953, San Marino, California. Millikan was the second son of Reverend Silas Franklin Millikan and Mary Jane Andrews. He led a rural existence in his childhood attending Maquoketa High School in Iowa. After a short stint as a court reporter, he joined the Oberlin College, Ohio, in 1886. Although his favourite subjects during his undergraduate years were Greek and mathematics, he developed a liking for physics when he took up a teaching post in physics for two years, after his graduation in 1891. This led to his mastership in physics in 1893 and he received his Ph.D. in 1895 for research on the polarization of light emitted by incandescent surfaces—using molten gold and silver from the US Mint for this purpose.



MILLIKAN, ROBERT ANDREWS
USA

After studying at the universities of Berlin and Göttingen he became professor at the University of Chicago, where he performed his famous oil drop experiment to determine the value of the electronic charge. He also verified Einstein's photoelectric equation and obtained a precise value for Max Planck's constant. He was honoured with the prize for his study of the elementary electronic charge and the photoelectric effect.

In 1921, he became director of the Norman Bridge Laboratory of Physics at the California Institute of Technology. There he made some initial studies on cosmic rays. He held the post of chairman of the executive council of the institute until his retirement in 1945.

Millikan was the recipient of many honours and represented the USA on the League of Nations committee for intellectual cooperation.

In 1902 he married Greta Erwin Blanchard; they had three sons.

Chemistry

For his invention of the method of micro-analysis of organic substances.

Pregl, Fritz, b.—September 3, 1869, Laibach, Austria now Ljublijana, Yugoslavia, d.—December 13, 1930, Graz. Pregl was educated in the "Gymnasium" at Laibach. He joined the University of Graz to study medicine, from where he received his M.D. in 1894. He became assistant lecturer for physiology and histology under Alexander Rollett, while still a student, and during this period acquired a thorough knowledge of all branches of chemistry. He went to Germany in 1904, and for short periods studied under Gustav V. Hufner in Tübingen, W. Ostwald in Leipzig, and Emil Fischer in Berlin. He returned to Graz in 1905 to work at the Medico-chemical Institute, where he was appointed forensic chemist for the Graz circuit in 1907. Pregl was appointed professor at Innsbruck University in 1910, and in 1913 went back to Graz. He was Dean of the Medical faculty in 1916-17, and Vice Chancellor of Graz University between 1920-21. Pregl was a bachelor.

Pregl determined the quantities of the various elements in organic compounds. His was an improvement of the previously used methods for quantitative analysis of relatively large quantities of substances. He used his own methods of quantitative micro-analysis, to make measurements of the different elements in organic compounds using only 5-13 mg. of starting materials with results as accurate as those obtained by micro-analysis. Later using only 3-5 mg. he perfected his techniques. By 1912, he was able to make reliable measurements of carbon, hydrogen, nitrogen, and sulfur with only a few milligrams of starting material.

PREGL, FRITZ
Austria

It is not sufficient to be able to determine with certainty the elemental composition of a substance, the molecular weight must also be known. To determine the molecular weight, Pregl constructed a micro-apparatus which makes it possible to work with such a small quantity, as 7-10 mg. He also designed an apparatus, the microbalance, to determine the quantity of important groups of atoms in a substance, in order to analyse its chemical constitution. Pregl devised a simple method for determining the functional capacities of kidneys.

His work can be well applied in all fields of organic chemistry. It has very good prospects in the vast field of biochemistry. Pregl's microanalysis offers an extremely valuable aid for a thorough chemical investigation of substances which is one of the most important tasks of biochemistry.

In 1917, Pregl published a monograph on his work, *Die Quantitative Mikroanalyse,* the second edition of which was published in 1923 and the third revised and enlarged edition in 1930. Later editions were revised by Dr. H. Roth, and the seventh edition appeared in 1958, published by Springer in Vienna. This monograph was translated into French and English.

Pregl was awarded the Prize for modifying and improving existing methods and not for a discovery as stated by the then Chairman of the Nobel Committee. Following this award, many chemists from all over the world visited the Medico-chemical Institute in Graz to study his techniques under his guidance. He also received the Lieben Prize for chemistry from the Imperial Academy of Science in Vienna in 1914. He was awarded an honorary doctorate in philosophy from the University of Göttingen (1920), and was elected corresponding Member of the Academy of Sciences in Vienna.

Just before his death due to an illness, Pregl donated a huge sum to the Vienna Academy of Sciences for the promotion of micro-chemical research, the interest accruing from which, he stipulated, was to be used each year in the award of a prize for outstanding work in micro-chemistry in Austria. Since then, the FRITZ PREGL PRIZE has been awarded by the Vienna Academy of Sciences.

Physiology or Medicine

For the discovery of insulin.

Banting, Frederick Grant, b.—November 14, 1891, Alliston, Ontario, d.—February 21, 1941, Newfoundland (in an aircrash). Banting attended the rural school and the high school in Alliston. He had a remarkably robust physique and an enquiring mind, both of which were to stand him in good stead in later life. He entered the University of Toronto, Victoria College, in 1912. He was not a brilliant medical student but his enquiring mind impressed his instructors and his classmates. In 1915, he joined the R.C.A.M.C. as a private. He was later sent back to complete his course in medicine and he was given his commission in the Medical Corps immediately after his graduation in 1916.

BANTING, Sir FREDERICK GRANT
Canada

He returned to Canada after World War I and was appointed Resident in Surgery in the hospital for sick children, Toronto. He became a well-qualified surgeon with particular interest in orthopaedics. In 1920, he began the practice of Medicine in London, Ontario, but it grew very slowly. He therefore obtained a position as part-time demonstrator in the University of Western Ontario. He conducted some research work there in the department of physiology (1920-21), but the results were not published until after the work on insulin was well under way. While preparing a lecture on diabetes, Banting was greatly stimulated by the idea that failure by previous workers to obtain the hormone of the pancreas was due to the fact that, the enzymes of the external secretion might have destroyed the hypothetical internal secretion during the course of preparation of the extract. The formulation of this idea was really the turning point in his life. It forced him to give up his practice and his position in London and to seek the opportunities available in Toronto for the testing of his hypothesis. These facilities were provided by Professor J.J.R. Macleod, head of the department of physiology. He sold his personal effects to secure money, and threw himself wholeheartedly into medical research which was to become his life's work.

In his Cameron Lecture in 1927 Banting described in detail the start of the investigations which led to the discovery of the internal secretion of the pancreas. This work was begun on May 16, 1921 in collaboration with C.H. Best (a senior student) who had been asked by Professor Macleod to participate. Banting shared the prize with Prof. J.J.R. Macleod for the discovery of insulin. Their closest associate in the above research, Charles H. Best was totally ignored, a matter of great regret for the entire world of sciences. But, Banting as a gesture of gratefulness shared half of his prize with Best and created a unique example. Macleod felt belittled so he too shared half of the prize money with J.B. Collip, then professor of medicine at the Toronto General Hospital, who applied crude insulin on his ward patients.

C.H. BEST

◆

For the discovery of insulin.

Macleod, John James Richard, b.—September 6, 1876, Cluny near Dunkeld, Perthshire, d.—March 16, 1935, Aberdeen. Macleod's father was a clergyman. He studied medicine in Aberdeen, graduating in 1898, whereupon he undertook various studies in Europe. Macleod held posts in physiology and biochemistry at the London Hospital and was Professor of Physiology at Western Reserve University, Cleveland, Ohio. Thereafter he took a similar post at the University of Toronto and later became Director of its physiological laboratory. He was consequently made Dean of the Faculty of Medicine.

Macleod was interested in carbohydrate metabolism and diabetes melitus. J.von Mering and Oskar Minkowski in 1889 discovered that the removal of the pancreas in dogs produced fatal cases of diabetes. Treatment of diabetes by regulating sugar intake was advanced by the time of the isolation of insulin in 1921, although severe cases were still invariably fatal. Preparation of the extracts of the pancreas proved to be difficult. F.G. Banting suggested that the difficulty was due to the breakdown of insulin by digestive enzymes. He further said that the ligaturing of the pancreatic duct could help in the extraction of insulin.

Under the direction of Macleod and with the help of Charles Best in 1921, Banting worked on his ideas at the University of Toronto. The pancreatic ducts of dogs were tied for seven weeks and the atrophied pancreas then removed. A saline extract of this proved to be effective in treating diabetes. Later efforts were made with the expert guidance of Macleod to extract pure insulin without resorting to ligaturing. Insulin was extracted purified based on the work of Banting and Best with the help of Macleod and J.B. Collip. The discovery of insulin relieved the suffering of many diabetic patients.

MACLEOD, JOHN JAMES RICHARD
Canada

Macleod worked on other subjects like air sickness, electric shock, purine bases, the carbamates and the tuberculosis bacterium. He was an outstanding teacher and guide for research work and he trained many successful scientists in his laboratories. He wrote a number of books which influenced budding scientists. They include *Practical Physiology* (1902) and *Physiology and Bio-chemistry in Modern Medicine* (1918) retitled *Physiology in Modern Medicine* in 1941.

J.B COLLIP

Literature

For his always inspired poetry, which in a highly artistic form gives expression to the spirit of a whole nation.

Yeats, William Butler, b.—June 13, 1865, Sandymount, Dublin, d.—January 28, 1939, Roquebrunne-Cap-Martin, France. A poet, dramatist and an Irish nationalist politician. He was the son

YEATS, WILLIAM BUTLER
Ireland

of a lawyer and the product of the Protestant Anglo-Irish cultural heritage. Although he had no formal education, he was endowed with a ready understanding and learnt a little Latin and even less of French.

In 1884, he enrolled in a Dublin Art School, where he met George Russel ("AE"), who turned his interest to mysticism and occultism. In 1885, some of his poems which were read by Gerald Manley Hopkins appeared in the *Dublin University Review*. He formed the Hermetic Society whose professed manifesto was that the poets are the modern heirs of the magicians who ruled in more primitive and more secret societies, and hence perfection of high poetry was their sole aim. He also joined the Young Ireland Society, which had John O'Leary and J.M. Synge in its ranks, and worked to establish Irish as a language. In 1890, he founded the Rhymers' Club and the Irish Literary Society.

He joined Madame Blavatsky's Theosophical Society through a nephew-in-law of Tagore, Mohini Mohan Chatterjee. He discovered the greatest Indian poet, Tagore, who, incidentally, won the Nobel Prize on his recommendation in 1913. He was first published in 1885.

His early books are *The Wanderings of Vision* (1889, Poetry) and *The Celtic Twilight* (1893, Essays). In 1889, he fell in love with a beautiful actress and a strong Irish nationalist Maud Gonne. She played a little role in his drama *Catheleen ni Houlhan* (1902). He was associated with Lady Gregory in founding the Abbey Theatre in Dublin. He wrote *On Baile's Strand* (1904) for the theatre as well as *At the Hawk's Well* (1916). He was a Senator of the Irish Free State during 1922-28. *The Wild Swans at Coole* (1917) established him as a poet of distinction. His most famous poem *Easter, 1916* relating to the Irish revolution was included in *Michael Robartes and the Dander* (1921). During the time of his greatest political activity, he wrote much of the finest poetry which was published in *The Tower* (1928) and *The Winding Stair* (1929). His *Last Poems and Plays* appeared in 1940 after his death.

He wrote a 22-page preface to the first English edition of Rabindranath Tagore's *Gitanjali*.

won the Nobel Prize [illegible] in 1923. He was first published in [illegible].

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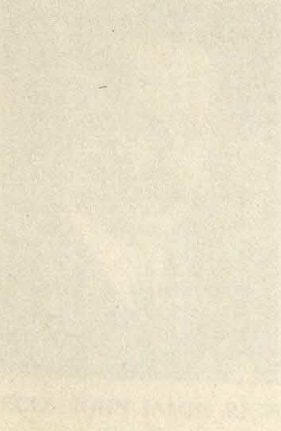

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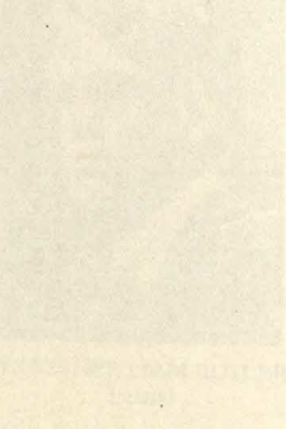

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1924

PHYSICS
Siegbahn, Karl Manne Georg
PHYSIOLOGY OR MEDICINE
Einthoven, Willem
LITERATURE
Reymont, Wladyslaw Stanislaw

1924

Physics

For his discoveries and research in the field of X-ray spectroscopy.

Siegbahn, Karl Manne Georg, b.—December 3, 1886, Oerebro, Sweden, d.—September 26, 1978, Stockholm. Seigbahn was the son of Nils Reinhold Georg Seigbahn, a Station Master, and Emma Sofia Mathilda Zetterberg. After high school he entered the University of Lund in 1906 and received his doctorate in 1911. He was assistant to Professor J.R. Rydberg from 1907 to 1911. In 1915, he became Deputy Professor of Physics. In 1920, after the death of Rydberg, he was appointed Professor of Physics. In 1923, he became Professor of Physics at the University of Uppsala and in 1937 Research Professor of Experimental Physics at the Royal Swedish Academy of Sciences.

SIEGBAHN, KARL MANNE GEORG
Sweden

In 1916, Siegbahn discovered a new group of spectral lines, the M-series. He developed the equipment and techniques that allowed him and subsequent workers to accurately determine the wave lengths of X-rays. A year after he became Professor of Physics at the Uppsala University, he proved that X-rays are refracted when they pass through prisms, just as ordinary light. Later, he also investigated the weaker X-rays that lie near the ultraviolet region of the spectrum.

In 1937, the Swedish Royal Academy of Sciences created the Nobel Institute of Physics at Stockholm, and appointed Siegbahn as its Director. The same year he became Professor of Physics at the University of Stockholm. In 1914, he married Karin Hogbom. They had two sons—Bo Siegbahn who is a senior diplomat and Kai Siegbahn, a physicist who received the Nobel Prize for Physics in 1981.

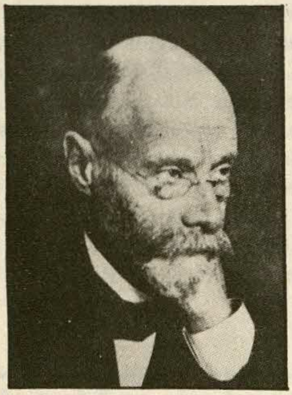
Physiology or Medicine

For his discovery of the mechanism of the electrocardiogram.

Einthoven, Willem, b.—May 21, 1860, Semarang, Java, now in Indonesia; d.—September 29, 1927, Leiden, Netherlands. Einthoven's father was a doctor. He followed his father's footsteps and studied medicine at the University of Utrecht and graduated in 1885. He served as Professor of Physiology at the University of Leiden, Netherlands, from 1886 until his death.

Einthoven was interested in the electrical activity of cardiac muscle. When a nervous impulse passes through the heart, causing it to contract and pump blood out, the electrical potential of the muscle changes. In 1903, he devised the first string galvanometer, known as the "Einthoven galvanometer", with which he was able to measure the changes of electrical potential caused by heart muscle contraction, and record them graphically.

The "Einthoven galvanometer" is a highly sensitive instrument which could detect changes in electric potential of the order of a fraction of a millivolt. The string was made of silver-coated quartz wire which was suspended between the poles of an electromagnet. Electrodes were attached to the limbs of the subject. These picked up the current caused by the ion flow preceding and following cardiac muscle contraction, and passed it through the wire which was deflected to one or other of the poles, depending on the strength and direction of the current. He could record the distinct changes which occurred as the heart contracted and relaxed. Einthoven called this instrument the "electrocardiograph"



EINTHOVEN, WILLEM
The Netherlands

In order to obtain a permanent record of the changes which occurred as the heart pumped blood, Einthoven arranged the string in such a way that when it was deflected it interrupted a beam of light and left a shadow on a moving strip of photographic paper. This record, known as the "electrocardiogram", was a repeating sequence of a wave pattern which corresponded to the contraction and relaxation of the heart. Einthoven labelled the distinct points of the wave P,Q,R,S and T.R is the now familiar spike of the electrocardiogram which occurs when the inlet valve of the heart closes and contraction begins, forcing the blood out.

The electrocardiograph does not measure the actual muscular contraction of the heart but the changes of electrical potential caused by heart muscle contraction on either side of the muscle membrane, caused by the changes in the concentration of the ions on either side of it. These changes spread from the sinuatrial node, the pace-maker of the heart.

The electrocardiogram of individuals, with a healthy heart, is standard. Einthoven recognized differences in the records of tracings obtained from different kinds of heart diseases.

The sensitivity of the electrocardiograph established its use in hospitals as an invaluable diagnostic instrument. Based on Einthoven's principle of the electrocardiograph, a modification was later made into an electronic device, using amplifier tubes and a cathode-ray oscilloscope. Einthoven continued to develop electrode arrangements, and the present day standard limb leads were originally devised and used by him.

Literature

For his great national epic, 'The Peasants'.

Reymont, Wladyslaw Stanislaw, b.—May 7, 1867, Kobielo Wielkie, Russian Poland, d.—December 5, 1925, Warsaw. His father was a windmiller living in Kobia Wielka with his large family of nine children. He went to a village school and often worked as a cowherd in his spare time. As per the Russian rules he was not allowed to speak in Polish language at school which he often disobeyed and as a consequence was turned out from the class!

REYMONT (pen-name of REYMENT),
WLADYSLAW STANISLAW
Poland

He read the works of Prus, Elisa, Orzesko, Dykasinski and Emile Zola. He also read the works of Sir Walter Scott, Augustine, The Church Father and the Bible. During his short span of life he worked as a clerk, railroad worker, telegraph worker and a theatrical actor. He passed through extreme hardships and indigence.

His first notable work was *Pielgrzymka do Jasney Gory* (Pilgrimage to the Mountain of Light, 1895), then he produced *The Comedian* (1896) followed by *Ferments* (1897), latter being a sequel to *The Comedian*. In 1899, he published *Ziemia obiecana* (The Promised Land). *The Peasants* (1904-09) was an immediate success. It was published in four volumes: *Spring, Summer, Autumn* and *Winter*. In all the volumes Polish peasant dialect infused the narrative which was its principal charm. This was followed by *Marzyciel* (The Dreamer, 1910), *Wampir* (The Vampire, 1911), the triology *Rok 1794* (The Year 1794, 1913-18). He then wrote four books of short stories and an allegorical story of the lives of animals *Bunt* (Defiance, 1924) which is his last complete work.

1925

PHYSICS

Franck, James / Hertz, Ludwig Gustav

CHEMISTRY

Zsigmondy, Richard Adolf

LITERATURE

Shaw, George Bernard

PEACE

Chamberlain, Sir Joseph Austen
Dawes, Charles Gates

1925

Physics

For their discovery of the laws governing the impact of an electron upon an atom.

Franck, James, b.—August 26, 1882, Hamburg, d.—May 21, 1964, Göttingen. After his initial education at the local grammar school, Franck studied chemistry at the University of Heidelberg for one year and then physics at the University of Berlin. He got his Ph.D. in 1906 under Warburg. He lectured in Berlin University from 1911 to 1918 and was appointed member and Head of the Physics Division in Kaiser Wilhelm Institute for Physical Chemistry at Berlin after World War I. In 1920, he became Professor of Experimental Physics and Director of the Second Institute for Experimental Physics at the University of Göttingen.

FRANCK, JAMES
Germany

He shared the prize with Gustav Hertz for research on energy changes that occur when atoms collide with electrons, from which it appeared that an electron must contain a certain minimum energy. Franck performed his prize-winning work at Göttingen , where he had been appointed Professor of Physics in 1920. In protest against Nazi anti-semetic policies he resigned his post and moved with his family to Baltimore, USA. He went to Denmark as a guest professor for a year. On his return to the USA in 1935, he was appointed Professor at Johns Hopkins University, and in 1938 became Professor of Physical Chemistry at the University of Chicago.

Franck's researches in the fields of photochemistry and atomic physics included determinations of the energy levels of the dissociation of molecules from the molecular band spectra. During World War II he worked on the development of the atomic bomb. He sought, however, to stop its use in warfare and suggested that it be exploded in an unpopulated area to reveal its power. During his later years he directed his attention to the reactions involved in photosynthesis.

Franck married Ingrid Josefson in 1911 and had two daughters. After the death of his first wife, he married, in 1946, Hertha Sponer, Professor of Physics at Duke University in Durham, North Carolina.

◆

For their discovery of the laws governing the impact of an electron upon an atom.

Hertz, Ludwig Gustav, b.—July 22, 1887, Hamburg, d.—October 30, 1975, East Germany. The son of Dr. Gustav Hertz, a lawyer, and Auguste, he attended the Johanneum School in Hamburg before entering Göttingen University in 1906. He graduated in 1911 after studying at the Universities of Munich and Berlin. His research at Berlin was interrupted when he was mobilized during World War I and was severely wounded in action in 1915. He returned to Berlin as Privatdozent in 1917 and later during 1920-25 worked in the

Physics Laboratory of Philips Incandescent Lamp Factory at Eindhoven. He was a nephew of the famous German physicist Heinrich Rudolf Hertz. He was appointed an assistant in physics at the University of Berlin in 1913, where he began to work with Franck. Their experiments showed that when an electron strikes an atom, it must possess a certain minimum energy in order to remove another electron from the atom. This energy, measured in volts, is called an ionization potential and varies for different elements. Their measurements showed that the spectral lines peculiar to a particular element corresponded to the series of possible energy states for the atoms of that element. This had been foreseen by the noted physicist Niels Bohr, who utilized the quantum theory to explain the nature of the atom.

HERTZ, LUDWIG GUSTAV
Germany

In 1925, Hertz was appointed Professor of Physics at the University of Halle and in 1928 Professor of Physics at the Technical High School in Berlin. In 1932, he devised a method of separating the isotopes of neon gas. Hertz was in Berlin in 1945 when the Soviet forces entered the city, and from 1945 until 1954 he was engaged in research in Soviet Russia. He returned to East Germany in 1954 and was Professor of Physics and director of the Physical Institute in Leipzig until 1961.

In 1919 he married Ellen Dihlmann; they had two sons, both physicists.

Note: The 1925 prize was divided equally between Franck and Hertz.

Chemistry

For his demonstration of the heterogenous nature of colloid solutions and for the methods he used, which have since become fundamental in modern colloid chemistry.

Zsigmondy, Richard Adolf, b.—April 1, 1865, Vienna d.—September 24, 1929, Göttingen, West Germany. His father, Adolf Zsigmondy was a dentist, who invented many surgical instruments and devices, and published several scientific and medical works. He was keen that his children take an interest in natural sciences.

Zsigmondy lost his father at the early age of 15 and was brought up by his mother who encouraged him to follow his own interests and lead an active outdoor life. So, much of Zsigmondy's time was spent in climbing, mountaineering, swimming and diving. He had developed at a young age an interest in chemistry and had a small laboratory in his home where he carried out simple experiments.

After receiving his Ph.D. from the University of Munich in 1889, he did research work at Berlin, and then joined the faculty of the University of Graz, Austria, in 1893. He then took up an appointment with the glass works, Schott und Genossen in Jena, where he worked until 1900. Here he directed his attention to colloid gold, present in ruby glass, and developed a water suspension of gold. He gave up his job to pursue scientific researches and in 1907 was appointed Professor and Director of the Institute of Inorganic Chemistry at the University of Göttingen, where he worked until his retirement in 1929. The award of the prize helped him to overcome the difficulties he faced during 1922-23 as an outcome of World War I.

Zsigmondy married Laura Luise, nee Müller, the daughter of Professor Wilhelm Müller, Lecturer in Pathological Anatomy in Jena, in 1903. They had two daughters; the elder daughter Annemarie married Dr. Eric Huckel, who was Zsigmondy's co-worker, and an assistant to Professor Debye in Zürich.

A colloid is characterized in that it is unable to pass through membranes such as parchment paper and diffuses extremely slowly. It is differentiated from a crystalloid, e.g. common salt, by the fact that the crystalloid, while in solution, readily passes through such membranes, and also exhibits a rapid free diffusion. The name colloid originates from the Greek word for glue. Examples of commonly known colloids are proteins, starch, rubber, etc. The same substance can either occur as a colloid or a crystalloid, hence the need to differentiate between colloidal and crystalloid states rather than colloidal and crystalloid substances.

ZSIGMONDY, RICHARD ADOLF
Germany

Zsigmondy theorized that much could be learned about the colloidal state of matter from studying the manner in which the particles scatter light. To facilitate such study, he and Heinrich Siedentopf, an optician with the firm of Zeiss, developed the ultramicroscope. The principle of this instrument is that the intensely illuminated object, which is the solution to be examined, is observed by means of microscope from the side, i.e. vertically to the axis of the incident light beam. This helps in the differentiation of particles of very small size, which cannot be observed under an ordinary microscope.

With the help of the ultramicroscopical study of gold colloids, Zsigmondy proved the heterogenous nature of colloidal solutions. His method has made it possible to determine the particle size, thus the degree of heterogeneity. Zsigmondy's pioneering work has helped in the better understanding of the mechanism of the coagulation phenomenon, and also the study of the structure of gels. The methods used by Zsigmondy have laid the foundation of modern colloid chemistry. His work proved particularly helpful in modern biochemistry and bacteriology.

Literature

For his work which is marked by both idealism and humanity, its stimulating satire often being infused with a singular poetic beauty.

Shaw, George Bernard, b.—July 26, 1856, Dublin, d.—November 2, 1950, Ayot St. Lawrence, Hertfordshire. The most significant playwright since the 17th century. His plays are full of his passion for social reforms. He first came to London from Ireland in 1879 and wrote a few insignificant novels like *The Irrational Knot* (1880), *Love among the Artists* (1881), *Cashel Byron's Profession* (1882) and *An Unsocial Socialist* (1883). He however made his reputation as a journalist and a political pamphlet writer. He was a prominent member of the Fabian society and also made a good name as a drama and music critic for papers like *The Star, The World* and *The Saturday Review*.

The Quintessence of Ibsenism (1891) made him famous and five years later he made his debut as a playwright with his drama *Widower's Houses* that was first performed in 1892 and was published in 1893 followed by *Arms and the Man* (1894) and *Mrs. Warren's Profession* (1894). He then wrote a succession of plays such as *Candida* (1894), *You Never Can Tell* (1895), *The Devil's Disciple* (1896), *Plays Unpleasant* (1898) and

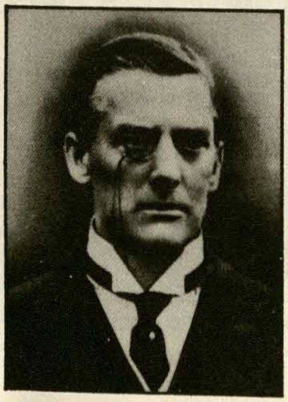
SHAW, GEORGE BERNARD
Great Britain

Plays Pleasant (1898) which were witty and amusing. The prefaces of his dramas contained his general viewpoint on the works and were extremely thought-provoking.

Among his famous works are *Caesar and Cleopatra* (published and first performed in 1901). *Man and Superman* (first performed in 1905 and published in 1907), *Major Barbara* (1905), *Heartbreak House* (1919), *Back to Methuselah* (1921) and *Saint John* (performed in 1923 and published in 1924). When Mahatma Gandhi was assassinated he reacted by saying, "It is too dangerous to be too good."

Peace

Chamberlain, Sir Joseph Austen, b.—October 16, 1863, Birmingham, d.—March 16, 1937, London. A British foreign secretary from 1924 to 1929, who helped to bring about the Locarno Pact, a series of treaties intended to secure peace in Western Europe by eliminating the possibility of border disputes involving Germany. The pact gained for Chamberlain a share along with American Vice-President Charles Gates Dawes of the Nobel Prize. On two occasions he refused an offer of the succession to the prime ministry of England, from David Lloyd George and Andrew Bonar Law. He was the eldest son of the statesman Joseph Chamberlain, and a half brother to the future British Prime Minister Neville Chamberlain, whose attempts to stop the outbreak of World War II in Europe by appeasing Adolf Hitler were a total failure. Sir Joseph entered the House of Commons in 1892, and rose to be Postmaster General and Chancellor of the Exchequer. He was a strong candidate to succeed former Prime Minister Arthur James Balfour as the Conservative Party leader but withdrew in favour of Andrew Bonar Law. During World War I, Chamberlain was secretary of state for India and a member of the War Cabinet. After the war, he became Chancellor of the Exchequer once more. From March 1921 until October 1922 he was leader of the Conservative Party.



CHAMBERLAIN, Sir JOSEPH AUSTEN
Great Britain

The Locarno Pact was concluded on Chamberlain's 62nd birthday by Great Britain, France, Italy, Belgium, and Germany. He lost popularity after the failure of the Geneva conference on naval limitations and the secret Anglo-French disarmament negotiations. He left office with Stanley Baldwin's second ministry and returned for a short time as the first Lord of the Admiralty, and then spent the rest of his life as a respected elder statesman.

◆

Dawes, Charles Gates, b.—August 27, 1865, Marietta, Ohio, d.—April 23, 1951, Evanston, Illinois, Vice-President of USA, ambassador, and author of the *Dawes Plan* for managing German War reparations payments after World War I. He was educated at Marietta College and Cincinnati Law School and practised law in Lincoln, Nebraska. He then moved to Evanston, Illinois, where he made his permanent home. He was US comptroller of currency from 1897 to 1902, when

DAWES, CHARLES GATES
USA

he returned to private business and organized the Central Trust Company of Illinois.

During World War I, Dawes was head of supply and procurement for the American Expeditionary Forces in France. He resigned as a brigadier general in 1919. In 1921, he was appointed the first US director of budget. Appointed by the Allied Reparations Commission to plan a solution for the problem of Germany's inability to pay for reparation to the Allies, Dawes submitted a plan (1924) providing for a reorganization of German finances with the assistance of loans from American investors. This plan saved Europe from economic collapse for a few years, but it proved to be a partial solution for the disorder of world economic disorganization.

Dawes was Vice-President of the United States under President Calvin Coolidge (1925-29) and from 1929 to 1932 he was US ambassador to Great Britain. During the depression he returned to the USA to direct the Reconstruction Finance Corporation. He resigned in the same year and resumed banking business.

He was the author of several works including *A Journal of the Great War* (1921), *Notes as Vice President* (1935), and *A Journal of Reparations* (1939).

Note: The 1925 prize was awarded jointly to Chamberlain and Dawes.

1926

PHYSICS

Perrin, Jean Baptiste

CHEMISTRY

Svedberg, The (Theodor)

PHYSIOLOGY OR MEDICINE

Fibiger, Johannes Andreas Grib

LITERATURE

Grazia, Deledda

PEACE

Briand, Aristide / Stresemann, Gustav

1926

Physics

For his work on the discontinuous structure of matter, and especially for his discovery of sedimentation equilibrium.

Perrin, Jean Baptiste, b.—September 30, 1870 Lille, France, d.—April 17, 1942, New York. Educated at the *Ecole Normalé Superieure,* Paris, he joined the University of Paris in 1898 where he became Professor of Physical Chemistry (1910-40). When the Germans invaded his country in 1940 he escaped to the USA where he died on April 17, 1942. After the war, in 1948, his remains were transferred to his fatherland and buried in the Pantheon.

PERRIN, JEAN BAPTISTE
France

In 1895, Perrin established that cathode rays are negatively charged particles. Around 1908, he determined the way in which colloidal particles remained suspended in a liquid in defiance of gravity. Through observations of the manner of sedimentation of these particles, he confirmed Einstein's equation for suspension phenomenon, and was also able to estimate the size of atoms and molecules as well as their quantity in a given volume. He studied the Brownian movement of minute particles suspended in liquids and thereby confirmed the atomic nature of matter.

Perrin was the creator of the *Centre National da le Recherche Scientifique* where Frederic Joliot later carried out his experiments. In addition, he founded the *Palais de la Deconverte* and was responsible for the establishment of the *Institut d' Astrophysique*, Paris, *Observatoire de Haute Provence* and *Institut de Biologie Physico-Chimique*.

Chemistry

For his work on disperse systems.

Svedberg, The (Theodor), b.—August 30, 1884, Fleräng, near Vallo, Sweden. His father, Elias Svedberg, was a works manager. He attended the Koping School, the Orebro High School and Gothenburg Modern School, where he passed his student examination in December 1903. In January 1904, he joined Uppsala University and gained his Bachelor's degree in 1905, Master's degree in 1907 and Ph.D. in 1908.

Svedberg became an assistant in the Chemical Institute at Uppsala in 1905, and Lecturer in Chemistry in 1907. In 1909, he was appointed Lecturer and demonstrator of Physical Chemistry, and in 1912 he was elected Professor of Physical Chemistry at the University of Uppsala. Since 1949, he has been Director of the Gustaf Warner Institute for Nuclear Chemistry, Uppsala.

Svedberg has married four times. In 1909, he married Andea Andreen, a medical graduate; in 1916, Jane Frodi; in 1938, Ingrid Blomquist; and in 1948, Marget Hallen, M.A. He has six sons and six daughters.

Svedberg worked on colloids and macromolecular compounds. In his doctoral thesis, which is considered a classic, he described a new method of producing colloid particles and gave convincing evidence of the validity of the theory, founded by Einstein and von Smoluchovski, of the Brownian movements. He studied the physical properties of colloids, such as their diffusion, light absorption, and sedimentation, from which could be concluded that the gas laws could be applied to disperse systems. He was able to confirm that a "few molecular" system having definite limits within a large volume of a material with a definite mean temperature, may contain a varying number of particles, partly by counting the colloid particles, partly in the case of solutions of radioactive substances by counting the number of light flashes, which radioactive particles produce when they impinge upon a screen coated with zinc sulphide.

SVEDBERG, THE (THEODOR)
Sweden

Svedberg constructed his extremely ingenious invention, the ultracentrifuge, which enables the study of molecular-disperse systems. This ultracentrifuge was used for the study of sedimentation. The large molecules put under the influence of centrifugal forces up to about 10^6 gravity showed that the molecules of certain pure proteins are all of one size, and demonstrated the use of the ultracentrifuge to show the presence of contaminants.

Svedberg's other works include the study of problems of nuclear chemistry and radiation biology, photographic processing where he assisted in photographing the famous *Codex argenteus* in colour which provided the source for Gothic language research. He also worked out a method for making synthetic rubber during World War II.

Svedberg travelled extensively to widen his knowledge. He visited Germany in 1908, Holland and France, 1912, Berlin, 1913, Vienna, 1916, London and Paris, 1920, England and Denmark, 1922, the United States and Canada, 1922-23.

Svedberg published several books : *Die Methoden Zur Herstellung Kolloider Lösungen anorganischer stoffee* (1909), *Die Existenz der Molekule* (1912), *Colloid Chemistry* (1914) whose second edition was published in 1928 with A. Tiselus, Nobel Laureate in Chemistry (1948) and *The ultracentrifuge,*(1940) which was also translated into German. He has written many popular books in Swedish : *Materien* (1912), whose second edition appeared in 1919 and the German edition in 1914, *Arbetets dekadens,*(1915, 1920, German edition, 1923) and *Forskuing och Industri* (1918).

He is the recipient of several Medals such as, John Ericsson Medal, 1942, the Berzelius Medal, 1944, and the Franklin Institute Medal, 1949. He has been awarded a number of honorary doctor's degrees in science and medicine. He is a member of the Swedish Academy of Sciences, the Halle Academy, the Chemical Society, London, the Indian Academy of Science, the American Philosophical Society, Philadelphia, the New York Academy of Sciences, the Royal Society, London, and the National Academy of Science, Washington. Svedberg's hobbies are painting and botany.

Physiology or Medicine

For his discovery of the Spiroptera carcinoma.

Fibiger, Johannes Andreas Grib, b.—April 23, 1867, Sikeborg, Denmark, d.—January 30, 1928 Copenhagen. A pathologist who received the prize for achieving the first controlled induction of cancer in laboratory animals, a development of profound importance to future cancer research. A student of the German Nobel Laureate bacteriologists Robert Koch and Emil von Behring in Berlin, he became Professor of Pathological Anatomy at the University of Copenhagen (1900). In 1907, while dissecting rats infected with tuberculosis, he found tumours in the stomachs of three animals. After intensive research, he discovered that the tumours, apparently malignant, followed an inflammation of stomach tissue caused by the larvae of a spiral worm now known as *Gongylonema neoplasticum*. The worms had infected cockroaches eaten by the rats.

FIBIGER, JOHANNES ANDREAS GRIB
Denmark

By 1913, he was able to induce gastric tumours consistently in mice and rats by feeding them cockroaches infected with the worm. By showing that the tumours underwent metastasis, he added important support to the prevalent concept that cancer is caused by tissue irritation. Fibiger's work immediately led the Japanese pathologist Yamagima Katsusaburo to produce cancer in laboratory animals by painting their skins with coal-tar derivatives, a procedure soon adopted by Fibiger himself.

It has been shown that vitamin A deficiency was a major cause of tumours in Fibiger's animals, and parasites play an insignificant role in causing cancer, as well as tissue irritation is one of the many direct causes of cancer. Fibiger's findings were a prelude to the production of chemical carcinogens, a vital step in the development of modern cancer research. He was one of the founder editors of *Acta Pathologica et Microbiologica Scandinavica.* He was also a co-editor of *Zieglers Beitraege.* Unfortunately, it was found in later times that the claims on tumour generation by Fibiger were fake!

Literature

For her idealistically inspired writings which with plastic clarity picture the life on her native island and with depth and sympathy deal with human problems in general.

Grazia, Deledda, b.—September 27, 1871, Nuoro, Sardinia, d.—August 15, 1936, Rome. An Italian novelist and a writer of the naturalistic school in Italian literature. She was born in a modest Sardinian family and was married very young. After marriage she settled in Rome but frequently visited Sardinia.

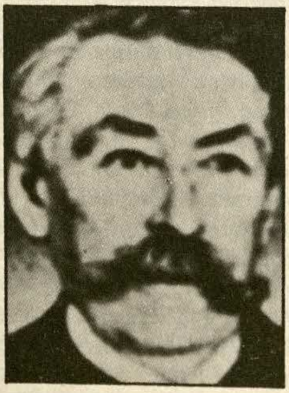
GRAZIA DELEDDA (pen-name of MADESANI GRAZIA née DELEDDA)
Italy

She had no formal education but she developed a natural realistic flare for writing the folklore themes of Sardinia and the tales of Sardinian rivalry, vendetta, kidnapping of babies' and fatal love affairs. Her first sketches and stories appeared at the age of thirteen in *Star of Sardinia,* and when 18, her stories were published in a fashion magazine *Ultima Moda*. Other stories were published in Milan by Trevisini under the title *Nell' Azzurro*.

Her important works are: *Fior di Sardegna* (Flower of Sardinia, 1892), *Anime Oneste, romanzo famigliare* (Honest Souls, 1895), *La Via del male* (The Evil Way, 1896), *Il vecchio della montagna* (1900, The Old Man of the Mountain), *Elias Portolu* (The Story of a Convict in Love with his Own Brother's Bride, 1903), *Cenere* (1904, English, Ashes, 1900), *L'edera* (1908, The Ivy), *Sino al confine* (Up To the Limit, 1910), *Il nostro padrone* (Our Master, 1910), *Nel deserto* (In the Desert, 1911), *Colombie sparvieri* (Doves and Falcons, 1912); *La madre* (1920, The Woman and the Priest, 1922) These novels were followed by *Segreto dell' uomo solitario* (The Secret of the Solitary Man, 1921), *Il Dio dei viventi* (The God of the Living, 1922), *La Fuga in Egitto* (The Flight into Egypt, 1925), *Annalena Bilsini* (1927) and *Il paese del vento* (Land of the Wind, 1931). She wrote her autobiography in *Cosima* and it was published posthumously in 1937.

Peace

Briand, Aristide, b.—March 28, 1862, Nantes, France, d.—March 7, 1932, Paris. A statesman who served 11 times as premier of France, holding a total of 26 ministerial posts between 1906 and 1932 and whose efforts for international cooperation, the League of Nations, and world peace won him the prize. As a law student, Briand became associated with left-wing causes, writing for such publications as *Le Peuple, Lanterne,* and *Petité Republiqué,* and in 1904 he joined Jean Jaures in founding *L' Humanite.* In 1894, Briand succeeded in geting the sharply divided French Socialists to adopt the general strike as a political tactic at a workers' congress at Nantes. After three unsuccessful attempts to be elected to the Chamber of Deputies, he became secretary-general of the Socialist Party. In 1902, he finally won election as a deputy from the Loiré department and remained a member of the Chamber until his death.



BRIAND, ARISTIDE
France

Briand's first success in government came with his work on the commission that drafted a law of separation of church and state in 1905. His report was published as *La Separation des eglises et de l'tat* (The Separation of the Church from the State). This achievement led to his appointment as minister of public education and culture but his acceptance of a post in a bourgeois government widened his break with Socialists. After serving another term as education minister in the first government of Georges Clemenceau, he became premier from July 1909-to November 1910, the first of his 11 terms. He served two brief terms, until March 1913, when his plan for proportional representation met defeat in the Senate.

On the fall of the Cabinet of Viviani in October 1915, Briand again became premier; he also took control of foreign affairs. Briand's war cabinet was unsuccessful in its attempts to cope with the lagging war effect. Forced to resign because of mounting pressures and the unsuccessful Balkan campaign, he spent the next three years taking little part in public affairs except for his outspoken advocacy of the League of Nations and the concept of collective security. He returned to the premiership in January 1921, but once again his policies were incapable of filling the hard demands of reconstruction of the war-ravaged France, forcing his resignation. In April 1925 he again took the post of foreign minister under Premier Paul Painleve which he held in 14 successive governments, four of those he headed himself. During that period his most notable successes were the Locarno Treaty, in which he, Germany's Gustav Stresemann, and Britain's Austen Chamberlain sought to normalize relations between Germany and its former enemies; and the "Kellogg-Briand Pact", in which 60 nations agreed to outlaw war as an instrument of national policy. In December 1930, Briand publicly and boldly advocated a federal union of Europe. He finally retired in January 1932, after an unsuccessful campaign for the presidency of the French Republic and dying shortly thereafter.

◆

Stresemann, Gustav, b.—May 10, 1878, Berlin, d.—October 3, 1929, Berlin. The chancellor and foreign minister of the Weimar Republic who was chiefly responsible for the restoration of Germany's international status after World War I. The son of an innkeeper, Gustav attended the universities of Berlin and Leipzig (1897-1900) and

STRESEMANN, GUSTAV
Germany

began his career as a businessman. Later as a member of the National Liberal Party, he was elected (1907) to the *Reichstag* (German Parliament) and eventually became the party leader. After the collapse of the German monarchy in 1918 he formed the German People's Party (*Deutsche Volks Partei),* which he headed until his death. In his later years, he served as chancellor (1923) and foreign minister (1923-29) of the Weimar Republic. He dealt with the problems of reconciliation with France and the Soviet Union and secured Germany's membership in the League of Nations.

Note: The 1926 prize was awarded jointly to Briand and Stresemann.

1927

PHYSICS

Compton, Arthur Holly

Wilson, Charles Thomson Rees

CHEMISTRY

Wieland, Heinrich Otto

PHYSIOLOGY OR MEDICINE

Wagner-Jauregg, Julius

LITERATURE

Bergson, Henri

PEACE

Buisson, Ferdinand / Quidde, Ludwig

1927

Physics

For his discovery of the effect named after him.

Compton, Arthur Holly, b.—September 10, 1892, Wooster, Ohio, d.—March 15, 1962, Berkeley, California. Compton was the son of Elias Compton, Professor of Philosophy and Dean of the College of Wooster, from where he graduated in 1913. He moved to Princeton University and received his M.A. degree in 1914. Compton received his Ph.D. from Princeton University in 1916 and became Head of the Department of Physics at Washington University, St. Louis. In 1923, he was appointed Professor of Physics at the University of Chicago where from 1942 to 1945, he was director of the "Metallurgical Project" that developed the first self-sustaining atomic chain reaction, paving the way for controlled release of nuclear energy. A deeply religious man he undertook the work in the belief that only the atom bomb could bring the war to a quick conclusion. He became Chancellor of Washington University in 1945 and was Professor of Natural History there from 1953 until 1961. He was joint winner with Wilson of England of the prize for his discovery and explanation of the wave length change of X-rays when they collide with electrons. This so-called "Compton effect" is caused by the transfer of energy from the photon to the electron. Its discovery in 1923 helped to establish firmly the dual nature of electromagnetic radiation as a wave and a particle.

COMPTON, ARTHUR HOLLY
USA

Compton married Betty Charity McCloskey in 1916. They had two sons, Arthur Allen who is in the American Foreign Service and John Joseph who is Professor of Philosophy.

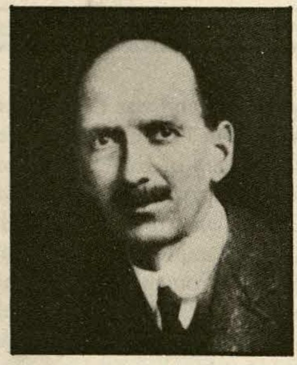
◆

For his method of making the paths of electrically charged particles visible by condensation of vapour.

Wilson, Charles Thomson Rees, b.—February 14, 1869, Glencorse, Midlothian, d.—November 15, 1959, Carlops, Peeblesshire. He was the son of John Wilson, a farmer, and Annie Clerk Harper. He studied in a private school in Manchester and later at Owens College. He graduated from Sidney Sussex College, Cambridge in 1892 with biology as the main subject, but picked up his interest in physical sciences here.

Wilson began studying clouds as a meteorologist in 1895. In an effort to duplicate the effects of certain clouds on mountain tops, he devised a way of allowing moist air to expand in a closed chamber. The expansion cooled the air so that it became supersaturated, and moisture condensed in dust particles. Wilson noted that when he used dust-free air, its supersaturation reached a certain critical point. He believed that in the absence of dust the clouds formed by condensing in ions in the air.

Hearing of the discovery of X-rays, he thought that ion formation as a result of such radiation might bring about more intensive cloud formation. He experimented and found that radiation left a trail of condensed water droplets in his cloud chamber. His chamber was perfected 11 years later, and eventually led to the development of the "bubble chamber". In 1916, Wilson became involved in the study of lightning and in 1925 was appointed Jacksonian Professor of Natural History at Cambridge. Applying his studies on thunderstorms, he devised a method of protecting wartime barrage balloons from lightning. He published a monograph on this subject, *A Theory of Thunderstorm Electricity*. He was joint recipient with Compton of the USA of the prize for his invention of a device called the "Wilson cloud chamber", which is widely used in the study of radioactivity, X-rays, cosmic rays, and other nuclear phenomena.



WILSON, CHARLES THOMSON REES
Great Britain

Wilson married Jessie Fraser in 1908; they had two sons and two daughters.

Note: The 1927 prize for Physics was awarded jointly to Compton and Wilson.

Chemistry

For his investigations of the constitution of the bile acids and related substances.

Wieland, Heinrich Otto, b.—June 4, 1877 Pforzheim, West Germany; d.—August 5, 1957, Munich. He was the son of Dr. Theodor Wieland and Elise Blom. His father was a pharmaceutical chemist in Pforzheim. Wieland studied at the universities of Munich, Berlin and Stuttgart and then returned to the Baeyer Laboratory in Munich where, in 1901, he received his doctorate. In Munich he received the *venia legendi* in 1904. In 1913 he became a Senior Lecturer in the chemical laboratory of the Munich University. He was appointed Professor of Chemistry at the *Technische Hochschule*, Munich, in 1917. He worked on Defence at the Kaiser Wilhelm Institute in Berlin-Dahlem during 1917-18. In 1921, he became Professor of Chemistry at the University and returned to the University of Munich in 1925 at Willstätter's request to succeed him in his chair. He worked here for twenty-seven years.

Wieland married Josephine Bartmann of Munich in 1908; they had three sons and one daughter, who is married to Feodor Lynen, Professor of Biochemistry in the University of Munich, Nobel Laureate in Medicine (1964).

Wieland was interested in the study of organic nitrogenous compounds. In 1911, he made important contributions to structural organic chemistry with his findings that different forms of nitrogen in organic compounds can be detected and distinguished from one another. In later years, he worked on the chemistry of natural substances. He spent much time in the investigation of oxidation processes in living cells, which enabled him to recognize dehydrogenation as a universal oxidation principle in nature. His later work led him to the belief that oxidation in living tissues is a matter of removing hydrogenations and not adding oxygen atmosphere. This theory proved to be of great importance in physiology, biochemistry and medicine.

WIELAND, HEINRICH OTTO
Germany

Bile acids are of major importance in the digestion process. Sterols are an extremely interesting group which play an important role in physiology. Cholesterol is the best known sterol that occurs in animals, and is found in bile, brain, nerve tissues, egg, blood and presumably in all cells.

Wieland succeeded in producing from bile a saturated acid, cholanic acid, which can be regarded as the mother substances of the bile acids. By a series of ingenious and complicated experiments, he produced the same in other substance, cholanic acids, from cholesterol.

Wieland, with his brilliant experiments, showed the close relationship between cholesterol and the bile acids. He found that the three acids isolated from bile were of similar structure and related to cholesterol.

His experiments helped in the better understanding of the action of the bile in the reabsorption of food in the intestines.

Wieland's work in later years involved the chemistry of natural substances. He clarified the structure of morphine and strychnine, worked on the constitution and synthesis of the lobelia alkaloid and researched into the curare alkaloid. His work on the poisonous agent in the death cap mushroom led to the isolation of the crystalline cyclopeptides *phalloidine* and *amanitine;* and his work on the pigment of butterflies led to the discovery of the biologically important class of pectin compounds.

Wieland, through his work, has contributed a great deal to chemistry, physiology and medicine, and his work has shown that these three main disciplines are inter-connected.

He received the Order of Merit and Haber Prize.

Physiology or Medicine

For his discovery of the therapeutic value of malaria inoculation in the treatment of dementia paralytica.

Wagner-Jauregg, Julius, b.—March 7, 1857, Wels, Austria, d.—September 27, 1940, Vienna. A psychiatrist and neurologist, whose treatment of syphilitic meningoencephalitis, or general paresis of insane (GPI), by artificial induction of hyperpyrexia by malaria in sufferers constituted the first example of shock therapy and brought a previously incurable fatal disease under medical control.

WAGNER-JAUREGG, JULIUS
Austria

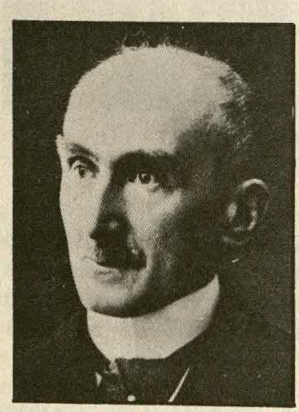
While a member of the psychiatric staff at the University of Vienna, he noted that persons suffering from certain nervous disorders showed a marked improvement after contacting febrile illnesses and he suggested that, such infections could be deliberately induced as a method of treatment for syphilitic insane. The same observation was also made by Avicenna (980-1037) and recorded in his treatise *Quanum el Fit Tibbi.* Jauregg specially recommended malarial fever because it could be easily induced and controlled with quinine therapy. As the Professor of Psychiatry and Neurology at the University of Graz, Austria, he attempted to induce fevers in psychic patients through the administration of an extract of tubercle bacillus (tuberculin), but the process met with very limited success. In 1917, while acting as the Professor of Psychiatry at the University of Vienna, he simultaneously directed the University Institute for nervous and mental diseases and was able to produce tertian malaria in GPI victims, with dramatically successful cures.

Although now the malarial treatment of GPI has been supplanted largely by the modern antibiotics, his work paved the way for the development of pyrexial therapy and shock therapy for a number of mental disorders. He is also known as an authority on cretinism and other thyroid diseases.

Literature

In recognition of his rich and vitalizing ideas and the brilliant skill with which they have been presented.

Bergson, Henri, b.—October 18, 1859, Paris, d.—January 4, 1941, Paris. Most widely read philosophers of the 20th century, Bergson was educated at the Lycee Condorcet and the *Ecole Normalé Superieure* in Paris. While teaching in the provinces and later from 1900 to 1921, he held the chair of philosophy in the College de France.



BERGSON, HENRI
France

He began to re-examine the current scientific notions based upon a spatialized conception of time and published *Essai sur les Donnees immediates de la conscience* (Time and Free Will) in 1889. His further study produced, *Matiere e memoire; Essai sur la relation due corps a l' spirit* (Matter and Memory, 1896). His most famous work is *L'Evolution creatrice* (Creative Evolution, 1917). In 1932 in *Les Deux Sources de la morale et de la religion* (The Two Sources of Morality and Religion) he justified his earlier views and reached the conclusion that the world is the sum total of all the conditions conducive to the emergence of godly men.

In 1914, he was elected to the Academie Francais and from 1921 to 1926, he was president of the Commission for Intellectual Cooperation of the League of Nations. During World War I he undertook diplomatic service and after the end of hostilities joined the League of Nations.

Peace

Buisson, Ferdinand, b.—December 20, 1841, Paris, d.—February 16, 1932, Thieuley-Saint-Antoine, Oise. An educator who reorganized the French primary school system.

Refusing to take the teacher's oath of loyalty to the French Second Empire of Napoleon III, Buisson went to Switzerland where he taught philosophy at Neuchâtel. In 1867, he took part in the first Geneva peace conference, where he advocated a United States of Europe. After the fall of Paris in the Franco-German War of 1870-71, he organized an asylum for war orphans. Under the French Third Republic he was appointed inspector general of the Paris public schools, but was forced to resign for recommending the elimination of religious instruction. As national director of elementary education, he aided Premier Jules Ferry in drafting statutes that took the public schools out of church control and made primary education free and compulsory. After teaching at the Sorbonne, he was elected to the national Chamber of Deputies.

BUISSON FERDINAND
France

In 1898 he helped to found the *Ligue des Droits de U Homme* (League of Human Rights). His peacemaking efforts as its president from 1913 to 1926, including the World War I period, and his postwar work for Franco-German amity, were primarily responsible for earning him the share of the Nobel Prize.

◆

Quidde, Ludwig, 1858-1941. He was one of the most prominent German pacifists, even though he was neither very bold nor consistent. He anonymously made propaganda for peace from 1893 by writing against German militarism. In 1894, he issued a pamphlet called, *Caligula,* which contained caustic remarks on Kaiser Wilhelm II and his coterie. The pamphlet aroused tremendous attention. In the same year he started a pacifist association in Munich. He was an active participant in international peace congresses. In 1907, he was elected a member of the Bavarian Assembly and participated in the International Parliamentary Congress. After the commencement of World War I, he tried to establish contacts with the pacifists in the belligerent as well as neutral countries and was a German delegate to The Hague meeting of 1915. He joined the campaign against the annexations of other countries and wrote a pamphlet entitled *Sollen wir annektiern?* (Should we annexe?). The pamphlet was immediately confiscated. In 1919, he became a member of the German National Assembly and made a violent speech against acceptance of the Versailles treaty, as he refused to recognize that Germany was solely responsible for the War. He devoted his energies to admit Germany into the League of Nations. He openly objected to the secret military training in Germany in contravention of the treaty of Versailles, through his writings in the periodical *Welt am Montag* (World on Monday). He was immediately arrested for the above.

QUIDDE, LUDWIG
Germany

Note: The 1927 prize was divided equally between Buisson and Quidde.

1928

PHYSICS

Richardson, Sir Owen Willans

CHEMISTRY

Windaus, Adolf Otto Reinhold

PHYSIOLOGY OR MEDICINE

Nicolle, Charles Jules Henri

LITERATURE

Undset, Sigrid

1928

Physics

For his work on the thermionic phenomenon and especially for the discovery of the law named after him.

Richardson, Sir Owen Willans, b.—April 26, 1879, Dewsbury, Yorkshire, d.—February 15, 1959, Alton, Hampshire. The only son of Joshua Henry and Charlotte Maria Richardson, he studied at Cambridge and graduated in 1900. In 1906 he joined the Princeton University, USA, where he was Professor of Physics (1906-13).

In 1911, he proved that electrons are emitted from hot metals and not from the surrounding air. In the same year he proposed a mathematical equation that relates the rate of electron emission to the absolute temperature of the metal. This equation, called "Richardson's law", later became an important aid in electron-tube research and technology.

RICHARDSON, Sir OWEN WILLANS
Great Britain

In 1914, Richardson became Professor of Physics and ten years later, director of research at King's College, London. He was knighted in 1939, and won the prize for his work on electron emission by hot metals, which is now widely used in the manufacture of vacuum tubes. The law was first announced by him before the Cambridge Philosophical Society in November 1901. It was used by Edison, John Fleming and De Forest to detect current across a vacuum, to devise a rectifier and to construct a triode.

Richardson married Lilian Maud Wilson, the only sister of H.A. Wilson, well-known physicist and his class-fellow in Cambridge. They had two sons and one daughter. After the death of his wife in 1945, he married physicist Henriette Rupp in 1948.

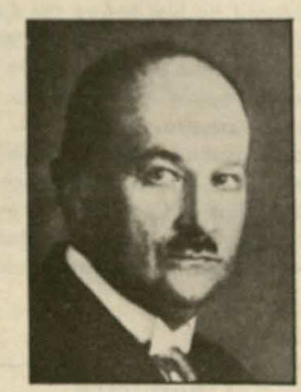
Chemistry

For the services rendered through his research into the constitution of the sterols and their connection with the vitamins.

Windaus, Adolf Otto Reinhold, b.—December 25, 1876, Berlin, d.—June 9, 1959, Göttingen, West Germany. Windaus was the son of Adolf Windaus and Margaret Elster. His ancestors had, for generations, been artisans. He attended the famous French grammar school in Berlin, where his main interest was literature. He initially studied medicine at the University of Freiburg, but later switched over to chemistry. After obtaining his Ph.D. from the University of Freiburg in 1899-1900 on Cardiac poisons of the Digitalis plant, he became Assistant Professor (1906) at Innsbruck University, Austria, and then Professor of Applied Medical Chemistry (1913). In 1915, he was appointed Professor of Chemistry at the University of Gottingen, where he stayed until his retirement in 1944 as Director of the Laboratory for General Chemistry.

Windaus married Elizabeth Resan in 1915; they had three children.

Windaus began his work on cholesterol and related sterols at Freiburg around 1901. He rightly believed that sterols, which occur in every cell must be considered as the parent substance of other groups of natural substances. In 1919, he transformed cholesterol into cholanic acid, which was achieved earlier by Weiland, Nobel Laureate in Chemistry, 1927. By the transformation of cholesterol into cholanic acid, Windaus established the close relationship between bile acids and sterols.



WINDAUS, ADOLF OTTO REINHOLD
Germany

Windaus also produced several of the digitalis glucosides and their components in the pure state. Digitalis glucosides belong to glucoside group, which is a group of vegetable cardiac poisons used in therapeutics. He successfully demonstrated that these vegetable cardiac poisons are directly related to cholesterol and bile acids on the one hand, and, on the other, to the animal cardiac poison bufotoxin, present in the skin secretion of certain species of toad, genus Bufo.

His research advanced the development of drugs in the treatment of cardiac disorders. Windaus investigated in detail another sterol ergosterol, which occurs partly in ergot and partly in yeast. He found that ergosterol on irradiation with ultraviolet light, assumes the same properties, i.e. curing of rickets, as Vitamin D. Irradiation of ergosterol resulted in the formation of 7-dehydrocholesterol, a precursor of the vitamin. This proves that ergosterol constitutes the mother substance of Vitamin D. As the leading expert on sterols, he was invited by the American physiologist Alfred Hess in 1925 to New York to help in the study of Vitamin D.

Windaus also investigated the rich field of imidazole derivatives. This was a result of his attempt to prepare natural amino acids through the action of ammonia on sugar, and thus to establish conversion of sugar into proteins. This reaction produced imidazole derivatives, which induced him to demonstrate the presence of a prototype of the imidazole ring in proteins. This helped him to demonstrate that *histidine,* an amino acid, is an imidazole *alanine,* and also to the discovery of *histamine,* a hormone of great physiological and pharmacological importance. His research also helped to establish the chemistry of sex hormones. His interest in imidazole derivatives prompted him to examine the structure of the antineuritic vitamins. He proved that a thiazole-and a pyrimidine-ring are present in Vitamin B and not an imidazole-ring as suggested by Jansen and Donath. He also investigated the possibility of chemotherapy in cancer research during the last years of his life.

Windaus, with his ingenious experiments, demonstrated the internal structure of organic materials, their relationships with one another, and their transitions into each other. His studies have shown that the fields of chemistry, physiology and medicine are interrelated and merge with each other.

He received the Pasteur Medal in 1938, the Goethe Medal in 1941, the Grand Order of Merit in 1951, and many other awards. He held honorary doctorates from the univeristies of Göttingen, Munich, Freiburg and Hanover.

Physiology or Medicine

For his work on typhus.

Nicolle, Charles Jules Henri, b.—September 21, 1866, Rouen, France, d.—February 28, 1936, Tunis. The son of a doctor, Nicolle received the prize for his discovery that typhus is transmitted by the body louse. After practising and engaging in bacteriological research in Rouen, he became director of the Pasteur Institute in Tunis. There he founded the Archives de l'Institut Pasteur de

Tunis, and during his tenure the Institute became a distinguished centre for bacteriological research and for production of serums and vaccines to combat various infectious diseases. He extended his work on typhus to distinguish between the classical louse-borne form and murine typhus, conveyed to man by the rat flea; he also made valuable contributions to the knowledge of rinderpest, brucellosis, measles, diphtheria and tuberculosis.

NICOLLE, CHARLES JULES HENRI
France

Literature

Principally for her powerful descriptions of Northern life during the Middle Ages.

Undset, Sigrid, b.—May 20, 1882, Kalundborg, Denmark, d.—June 10, 1949, Lillehammer, Norway. A Norwegian novelist whose father was an archaeologist. In her childhood she heard lots of folklores and legends of Norway, which influenced her future writings.

She published her first novel in 1907, *Fru Marte Oulie* (Mrs. Martha Oulie), followed by *Den lykkelige alder* (The Happy Age, 1908), *Fattige skjaebner* (Fates of the Poor, 1913), *Varen* (Spring, 1914). In *Elleve aar* (1934, Eleven Years, 1935) she described her childhood and the story of her escape from Nazi-occupied Norway.

UNDSET, SIGRID
Norway

Her early novels deal with the woman's position in the contemporary middle class society. Those include, *Splinten av troldspeilt* (1917, Images in a Mirror, 1938), *Jenny* (1911, English, 1921) and *De Kloge jomfruer* (The Wise Virgins, 1918). Her triology, *Kristin Lavransdatter* (1920-22, English, 1923-27) is one of her most popular works. She also wrote *Olav Andunssoen* (1925-27, The Master Hestviken, 1928-30) which is a historical treatise in four volumes.

She returned to modern themes in her later novels like *Gymnadenia* (The Wild Orchid, 1929), *Den braendende busk* (The Burning Bush, 1930), *Ida Elisabeth* (1932), *Den trofaste husfru* (The Faithful Wife, 1936). In 1940, she was asked to flee Norway during the Nazi invasion, because of her anti-Nazi essays. She reached the United States via Sweden, Russia and the Pacific. In 1949, before her death, she was awarded the Grand Cross of the Order of Saint Olav by the King of Norway, Haokon.

1929

PHYSICS

De Broglie, Prince Louis Victor

CHEMISTRY

Harden, Sir Arthur

Von Euler-Chelpin, Hans Karl August Simon

PHYSIOLOGY OR MEDICINE

Eijkman, Christiaan

Hopkins, Sir Frederick Gowland

LITERATURE

Mann, Thomas

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Kellogg, Frank Billings

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1929

Physics

For his discovery of the wave nature of electrons.

De Broglie, Prince Louis Victor, b.—August 15, 1892, Dieppe, Siene-Marne, France; d.—March 19, 1987, Paris. The de Broglies were ennobled by Louis XIV and served the French royalty in the military and diplomatic services. The French Revolution was a trying time for the family and at least one de Broglie died at the guillotine. In the 1800s, however, they were regarded as one of the most influential families in France. Born in an affluent and aristocratic family, Louis had a sophisticated and scholarly home life and developed a wide range of interests. He was educated in the Sorbonne, Paris, in history and it was not until World War I that he began to concentrate on science. During the war he served as a radio engineer and was posted to the Eiffel Tower as a member of the signals unit. His interest in theoretical physics grew and, breaking family tradition, he joined the Sorbonne to do his doctorate in 1924. His thesis was a work of brilliance that revolutionized scientific thinking. He taught at the Sorbonne, serving as Professor of Theoretical Physics at the newly founded Henri Poincare Institute from 1928 to 1962.

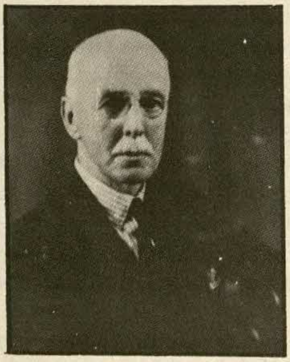
DE BROGLIE, Prince LOUIS-VICTOR
France

In the early 1900s there was much excitement about Albert Einstein's theory of relativity and Max Planck's quantum theory. The theory of relativity changed the physicists' conventional view of the physical world. Einstein's theory of relativity led to the concept that matter itself was a form of energy. More specifically, he explained the photoelectric effect by the concept that electromagnetic radiation (a wave) can also behave as particles (protons). Later in 1923, Arthur Compton produced further evidence for this view while explaining the scattering of X-rays by electrons. In 1924 de Broglie, influenced by Einstein's work, put forward the converse idea that just as waves can behave as particles, particles can also behave as waves. He proposed that an electron, for instance, can behave as if it were a wave motion (a de Broglie wave) with wavelength h/p where p is the momentum of the electron and h is Planck's constant. This revolutionary theory was put forward in de Broglie's doctoral thesis. Experimental support for it was obtained independently by George Thomson and Clinton J. Davisson. The wavelike behaviour of particles was used by Erwin Schroedinger in his formulation of wave mechanics. The fact that particles can behave as waves, and vice versa, is known as wave particle duality and has caused intense debate as to the "real" nature of particle and electromagnetic radiation. De Broglie had always taken the view that there is a true determinable physical process underlying quantum mechanics, i.e. the current indeterminate approach in terms of probability can be replaced by a more fundamental theory. He based his ideas on the concept of particle that are concentrations of energy guided through space by a real wave, and exchanging energy with a "sub-quantum medium".

Chemistry

For their investigations on the fermentation of sugar and fermentative enzymes.

Harden, Sir Arthur, b.—October 12, 1865, Manchester, d.—June 17, 1940, Bourne, Buckinghamshire. After studies at Manchester and Erlangen, Germany, he became a lecturer-demonstrator at the University of Manchester. In 1897 he joined the Jenner Institute for Preventive Medicine, and became Head of its Biochemistry Department in 1907, a post he held until his retirement in 1930. During World War I he was acting head of the Institute, and did notable work on nutrition.



HARDEN, Sir ARTHUR
Great Britain

Harden is chiefly remembered for his work on the alcoholic fermentation of sugars. Buchner (Nobel Laureate) had ascribed the fermentation of sucrose to an hypothetical enzyme "zymase". Harden proved "zymase" to be a complex mixture of enzymes each component of which catalyzed one stage in the stepwise degradation of sucrose to ethanol. His study of the fermentation of sugar for over 20 years advanced the knowledge of intermediary processes in all living organisms. He showed that the essential first step was the phosphorylation of sucrose, and that carbohydrate phosphates were key intermediates in the process. He also studied the conversion of glycogen to lactic acid in muscle. His other studies include pioneering work in bacterial enzymes and metabolism.

Harden wrote *Alcoholic Fermentation* (1911) and was co-author of *A New View of the Origin of Dalton's Atomic Theory* (1896). He served as joint Editor of the *Biochemical Journal* (1913-37).

For his distinguished work Harden was awarded the prize jointly with H. Von Euler. He was made Fellow of the Royal Society in 1909 and knighted in 1936.

◆

For their investigations on the fermentation of sugar and fermentative enzymes.

Von Euler-Chelpin, Hans Karl August Simon, b.—February 15, 1873, Augsburg, d.—November 6, 1964, Stockholm. His father was a General in the Royal Bavarian Regiment and he spent most of his childhood at Wasserburg. After going to school at Munich, Würzburg and Ulm, he studied art from 1891 until 1893 at the Munich Academy of Painting. His desire to study problems of colour, especially the colour of the spectrum, led Von Euler-Chelpin to study science in 1893. He studied chemistry at the University of Berlin under Emil Fischer (Nobel Laureate) and A. Rosenheim and Physics under E. Warburg and Max Planck (Nobel Laureate). In 1895 he took his doctorate from the University of Berlin.

After a short course in physical chemistry in Berlin, he went to the University of Göttingen in 1896-97, to work under W. Nernst (Nobel Laureate). In 1897 he was appointed assistant to Svante Arrhenius (Nobel Laureate) in Stockholm, and was qualified as Privatdozent in Physical Chemistry in the Royal University at Stoc-

VON EULER-CHELPIN, HANS
KARL AUGUST SIMON
Sweden

kholm and was appointed as such in that University. He visited the laboratory of Van't Hoff between 1899-1900. In 1906 he was appointed Professor of General and Organic Chemistry in the Royal University, Stockholm. He was appointed Director of the Vitamin Institute and Institute of Bio-chemistry in 1929 in Stockholm, established the same year by the Knut and Alice Wallenberg Foundation and the international Education Board of the Rockefeller Foundation.

The work of Von Euler has contributed to the unravelling of the mechanism of phosphorylation during fermentation. He said that the primary function of phosphoric acid in fermentation was to yield glucose monophosphate in the presence of an enzyme. Later this phosphate undergoes a mutation in the presence of co-zymase to form glucose diphosphate and an active glucose, and this glucose yields the necessary material for the subsequent stages of the fermentation. The demonstration of the identity of co-zymase and co-mutase have helped in the understanding of the key role they play in fermentation. This research has led to the concentration of the co-zymase and an accurate study of its properties. This work has also helped in drawing important conclusions concerning carbohydrate metabolism in general in both plants and animals. Von Euler with his work has made fully evident the importance of Honden's discovery.

Von Euler also helped to elucidate the chemical structures of several vitamins. He investigated the biochemistry of tumours and especially studied the nucleic acids in tumours by means of labelled compounds by a technique he invented in collaboration with G. de Hevesy.

Von Euler was awarded jointly with Arthur Harden the 1929 Nobel Prize for Chemistry. In recognition of his work Von Euler was awarded honorary doctorates of the universities of Stockholm, Zürich, Athens, Kiel, Berne, Turin, Rutgers and New Brunswick. He was Fellow of a number of Academies of Sciences all over the world. He was a Member of the Royal Swedish Academy of Sciences, the Royal Swedish Academy of Engineering Sciences, the Royal Institution, London, the Finnish Academy of Sciences, and the Academy of Sciences, New Delhi, a Foreign Member of the Max Planck Society, a Corresponding Member of the Academy of Sciences, Paris, and an honorary member of the Academies of Sciences of Helsinki and Japan, the Indian Academy of Sciences, the Chemical Societies of France, Italy and Berlin, and of the Japanese Cancer Association, Tokyo. In 1959, he was awarded the Grand Cross for Federal services with Star, Germany.

Von Euler had a number of publications to his credit. Between 1925 and 1935, the results of his very extensive research in enzymology were published in *Chemie der Enzyme,* which was the first modern monograph on this subject. He published a book on chemistry and biochemistry in 1957 which was co-authored by B. Eistert. His other publications include *The Biochemistry of Tumours* (1942) and *The Chemotherapy and Prophylaxis of Cancer* (1962).

Von Euler-Chelpin married twice. With his first wife he worked on certain aspects of organic chemistry. In 1913 he married for the second time, and his wife collaborated with him in his work. He had nine children by his second marriage. His son Ulf von Euler also won a Nobel Prize for Physiology or Medicine along with Julius Axelrod and Bernard Katz in 1970.

Note: The prize was divided equally between Harden and Von Euler-Chelpin.

Physiology or Medicine

For his discovery of the antineuritic vitamin.

Eijkman, Christiaan, b.—August 1, 1858, Nijkerk, Netherlands, d.—November 5, 1930, Utrecht. Eijkman was the son of a school-master, educated at Zandaam, and then trained as a medical officer for the Army of the Dutch East Indies. He graduated in medicine at Amsterdam in 1883 and was a student of Robert Koch, the German bacteriologist and Nobel Laureate, in Berlin. Eijkman travelled to the Dutch East Indies to investigate the widespread oriental disease *beriberi* (stiffgaited). On his return to Europe in 1887 he was appointed Director of the research laboratory for pathological anatomy and bacteriology in Batavia, Jakarta, which he retained until 1896. In 1898, he was called to the Chair of Hygiene and Forensic Medicine at Utrecht. He was appointed a member of the Royal Academy of Sciences of the Netherlands in 1907.

Eijkman's initial attempts to find a bacterial cause for *beriberi* failed. The civilian research laboratory of which Eijkman was Director was situated in a military hospital at Batavia. In 1890, a disease known as polyneurities broke out among his laboratory chickens. The condition was characterized by an ascending paralysis ultimately affecting the respiratory muscles, which bore a striking resemblance to *beriberi.* Infection did not seem to be the cause of the disease. Eijkman discovered that the laboratory attendant had, for a short period, fed the birds on cooked rice obtained from the hospital kitchen. The new cook, however, had not allowed rice from the military hospital to be fed to the laboratory chickens and the disease, in course of time, had disappeared in the chickens.

EIJKMAN, CHRISTIAAN
The Netherlands

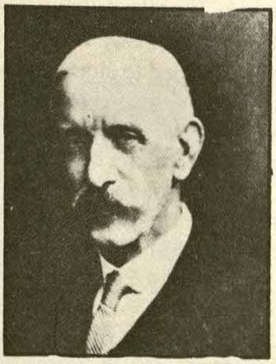
Eijkman proved that the disease could be produced by feeding chickens on polished rice instead of on unmilled rice, and that the husk removed by polishing would cure the disease when administered with the polished rice. This work helped scientists to experiment on the prevention and cure for *beriberi,* afflicting prisoners in the Far East.

Although Eijkman believed that husks contained a protective factor which countered an excess of carbohydrate in the diet, he misinterpreted his results, thinking that the husk contained a special protein or salt, or alternatively a protective substance against some poison. His successor in Batavia, Grijns, soon demonstrated that they contained a nutritive factor, later isolated and named Vitamin B_1 or thiamine.

◆

For his discovery of the growth-stimulating vitamins.

Hopkins, Sir Frederick Gowland, b.—June 20, 1861, Eastbourne, East Sussex; d.—May 16, 1947, Cambridge. He was the only son of Frederick Hopkins, a first cousin of the poet Gerard Manley Hopkins. His father died when he was an infant. He lived the first ten years of his life with his widowed mother at Eastbourne, and had a lonely and unhappy childhood. He was educated at the City of London School, and articled to a consulting analyst for three years. He became an analytical assistant at Guy's Hospital to Sir Thomas Stevenson, Home Office analyst, and read for the B.Sc. (London). In 1888 he became a medical student in Guy's Hospital and qualified in 1894. During 1894-98 Hopkins was assistant in the Department of Physiology at Guy's Hospital and qualified in 1894. During 1894-98 Hopkins was assistant in the Department of Physiology at Guy's Hospital and carried on his research work. In 1898, he became Lecturer in Chemical Physiology at Cambridge, where he remained for the rest of his life. After a serious illness in 1910 due to overwork, he was offered a praelectorship with no formal duties by Trinity College, which he held till 1921. In 1921, he became the first Sir William Dunn Professor of Biochemistry and retained the post till 1943.



HOPKINS, Sir FREDERICK GOWLAND
Great Britain

Hopkins' first research publication was in 1891, on the method of determining uric acid in urine. He studied the pigments of the wings of butterflies, which he believed was related chemically to uric acid. He devised a method for obtaining crystalline proteins, and distinguished himself by his classical paper on the chemistry of muscle contraction. He identified glyoxylic acid as the impurity in commercial acetic acid.

In 1901, he discovered the amino acid tryptophan, isolated it from protein, and eventually showed that tryptophan and certain other amino acids known as the essential amino acids cannot be manufactured by certain animals from other nutrients and must be supplied in the diet. Noticing that rats failed to grow on a diet of artificial milk but grew rapidly when a small quantity of cow's milk was added to their daily ration, Hopkins realized that no animal can live on a mixture of pure protein, fat and carbohydrates, even when mineral salts are added, and termed the missing factors *vitalamines,* which eventually came to be known as vitamins.

In 1907, Hopkins and Sir Walter Fletcher laid the foundation for a modern understanding of the chemistry of muscular contraction when they demonstrated that working muscle accumulated lactic acid. Fifteen years later, Hopkins isolated the tripeptide glutathione from living tissue and showed that it is vital to the utilization of oxygen by a cell. This substance is most important in maintaining the activity of enzymes by preventing oxidation of their sulphur containing parts.

He was awarded the prize for his work on the chemistry of intermediary metabolism which eventually led to the identification of the part played by vitamins in the chemistry of the life processes. He was elected Fellow of Royal Society in 1905 and was a member of the first Medical Research Committee appointed in 1913. He was knighted in 1925 and appointed Order of Merit in 1935. He was President of the Royal Society during 1930-35 and of the British Association in 1933. In addition to these, he received a number of honorary degrees.

He married and had three children, a son and two daughters, one of whom married J.B. Priestly and became well known as the author of *Jacquettta Howkes.*

Note: The 1929 prize was divided equally between Eijkman and Hopkins.

Literature

Principally for his great novel, 'Buddenbrooks', which has won steadily increased recognition as one of the classic works of contemporary literature.

Mann, Thomas, b.—June 6, 1875, Luebeck, d.—August 12, 1955, near Zürich. A novelist whose works were full of artistic thoughts and reality and revealed the social and political upheavals during his time. The conceited German aristocracy and the problems of creative artists are the theme of his early novels and short stories. *Buddenbrooks* (1900), *Tonio Kroger* (1903), *Koenigliche Hoheit* (Royal Highness, 1909) and *Death in Venice* (1912) belong to his early writings.

In 1913, the University of Bonn awarded him an honorary doctorate in philosophy. World War I gave him an authoritarian outlook but it was gradually subdued by the time he published *Der Zauberberg* (The Magic Mountain, 1924); the menacing rise of Hitler engendered his open hostility of Fascism and Nazism. He was exiled from Germany and settled in the USA as a Professor at the Princeton University. He became a US citizen in 1944.

MANN, THOMAS
Germany

His later works include *Mario und der Zauberer* (Mario and the Magician, 1930), *The Tales of Jacob* (1933), followed by the second volume *Der Junge Joseph* (Young Joseph, 1934) which led to the third volume *Joseph in Egypt* (1936), and in 1942 he completed the tetrology in *Joseph the Provider. Lotte in Weimer* (1939), *Doctor Faustus* (1947). *The Confessions of Felix Krull, Confidence Man* (1954) and essays on literary, political and philosophical subjects.

Peace

Kellogg, Frank Billings, b.—December 22, 1856, Potsdam, New York, d.—December 21, 1937, St. Paul, Minnesota. One time US Secretary of State whose most important diplomatic achievement was the Kellogg-Briand Pact of 1928, a multilateral agreement designed to prohibit war as an instrument of national policy. Kellogg achieved prominence as a lawyer representing the American government in antitrust cases, and served in the US Senate and as an ambassador to Great Britain.

As the Secretary of State under President Coolidge, he generally followed an isolationist policy regarding European affairs, but he helped to arrange an international conference at Geneva that sought unsuccessfully to limit naval armaments.

KELLOGG, FRANK BILLINGS
USA

In 1928, the French foreign minister, Briand, had evolved a plan for a bilateral pact outlawing war as a tool of national diplomacy. Kellogg delayed for months, partly fearful of a two-nation entanglement. He was motivated into action by vocal US proponents of the "outlawry of war" movement, he succeeded in broadening the agreement including all the major powers. He also served on the Permanent Court of International Justice.

1930

PHYSICS

Raman, Sir Chandrasekhara Venkata

CHEMISTRY

Fischer, Hans

PHYSIOLOGY OR MEDICINE

Landsteiner, Karl

LITERATURE

Lewis, Sinclair

PEACE

Söderblom, Lars Olof Nathan

1930

Physics

For his work on the scattering of light and for the discovery of the effect named after him.

Raman, Sir Chandrasekhara Venkata, b.—November 8, 1888, Tiruchirapalli, India, d.—November 21, 1970, Bangalore, India. Son of a Physics teacher, Raman joined Presidency College in Madras in 1903 and passed B.A. in 1904 and M.A. in 1907 with highest distinctions. He entered the Civil Services since scientific research was almost neglected in India at that time. He worked for ten years in the Finance Department in Calcutta with short periods in Nagpur and Rangoon and during this period did research work in spare time.

Raman came into contact with Sir Asutosh Mookerjee, Vice-Chancellor of Calcutta University, through the Indian Association for the Cultivation of Science, who offered him the post of Professor of Physics. He retained this post from 1917 to 1933 and from 1919 acted as Secretary for the Indian Association for the Cultivation of Science. With hard work and dedication he built up both the institutions and inspired young scientists to study physics.

Studying the scattering of light in various substances in 1928, he found that when light of one frequency was transmitted through a medium other frequencies were added and that they were characteristic of the material. These so-called "Raman frequencies" are equal to the infrared frequencies for the material and are caused by the exchange of energy between the light and the material. This discovery provided much valuable information on molecular rotation and, particularly, vibration, and thus on the shape and symmetry of molecules themselves. His Nobel prize winning research work was carried out entirely at the old laboratory of the Indian Association for the Cultivation of Science, Calcutta.

Raman's work was acclaimed internationally. He visited England in 1921 for the Universities Congress in Oxford, and Canada in 1924 as the guest of the British Association. In 1924, the Royal Society elected him to its Fellowship and in 1930 bestowed on him the Hughes Medal. The same year he was awarded the prize for his discovery of the effect named after him. He was honoured by many universities and scientific institutions in America, Russia, Europe and his own country, India. He was knighted in 1929.

RAMAN, Sir CHANDRASEKHARA VENKATA
India

Raman was elected Professor of Physics (1933-49) and for a short time Director of the Indian Institute of Science in Bangalore. During his tenure here, he built the facilities for research and at the same time carried on his investigations on X-ray crystallography, on the diffraction of light by high frequency sound waves in liquid, and on other optical problems. He founded the Indian Academy of Sciences in 1934, directed the regular publication of its *Proceedings,* and remained its President till his death.

In 1949, Raman established an independent scientific institution, now known as the Raman Research Institute, on the outskirts of Bangalore. He was honoured as the father of Indian Science and the Government of India bestowed on him the first of its National Professorships.

Raman published a number of papers in *Nature, Philosophical Magazine* and the *Physical Review*. In 1922, the Calcutta University published his book *Molecular Diffraction of Light.* These papers brought him recognition among the scientific elite in Europe and America. His essay *On the Mechanical Theory of the Vibrations of Bowed Strings and of Musical Instruments of the Violin Family* appeared as a bulletin of the IACS in 1918. He published original optical work when he was barely eighteen years old in the *Philosophical Magazine.* His discovery of the "Raman Effect" was announced in the *Indian Journal of Physics,* of which he was the founder editor.

Chemistry

For his researches into the constitution of haemin and chlorophyll and especially for his synthesis of haemin.

FISCHER, HANS
Germany

Fischer, Hans, b.—July 27, 1881, Höchst-am-Main, Germany, d.—March 31, 1945, Munich. Fischer's father was a Director of the chemical firm of Kalle and Co. He studied medicine and chemistry at Marburg and Lausanne, and became assistant to Emil Fischer (Nobel Laureate) in Berlin. After receiving his Ph.D. in Chemistry from Marburg-an-der-Lahn (1904) and his M.D. from Munich (1908), he worked as a Physician and did research work in medical chemistry before becoming Professor of Medical Chemistry in Innsbruck (1915) and Vienna (1918). Hardly any research was done during the war, and, in 1921, Fischer returned to Munich as successor to H. Wieland in Technische Hochschule where he settled down to do productive work.

Fischer had begun his studies of the bile pigments in Munich in 1910, but had given it up when he took up the post of Professor in Innsbruck. He achieved his first major success, however, with his studies of haemin, the non-protein part of haemoglobin, the oxygen-transporting pigment of vertebrate blood. He showed haemin to have a macrocyclic structure, the "porphyrin" ring, consisting of four different substituted pyrroles joined by –CH-groups, and having at their centre an atom of iron. He confirmed this structure by a remarkable synthesis in 1929.

Fischer showed that the bile pigments were linear tetrapyrroles formed by oxidative degradation of porphyrins, the details of whose synthesis he published in 1944. R. Willstätter's work in the 1910s on the structure of the chlorophylls, the green photosynthetic pigments of plants, was taken up by Fischer twenty years later. He demonstrated that the chlorophylls were substituted porphyrins with an atom of magnesium at the centre, and showed that there is a close relationship between haemin and chlorophyll. Chlorophyll was eventually synthesized by others. Fischer also studied the yellow pigment carotene, a precursor of vitamin A, and the porphyrins.

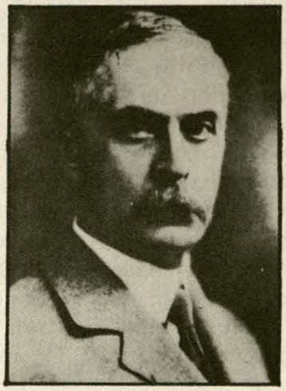
Fischer married late in life and had no children. General confusion and depression caused during the war resulted in his taking his own life in the final weeks of the war.

Physiology or Medicine

For his discovery of human blood groups.

Landsteiner, Karl, b.—June 14, 1868, Vienna, d.—June 26, 1943, New York. Landsteiner graduated in medicine from the University of Vienna in 1891 and studied chemistry for the next five years in various European universities. While a research assistant at the Vienna Pathological Institute, he found the basic differences in human blood in 1900 that explained the excessive danger involved in indiscriminate transfusions of whole blood in humans. Landsteiner published the analysis of his results the same year.

The dangers of blood transfusion, which was being practiced in the 17th century led to the outlawing of this practice until the early 19th century, when it was revived. It was still considered dangerous because the transfused blood often clotted. Landsteiner was puzzled by the fact that when blood from different subjects was mixed, sometimes there was coagulation and other times nothing happened. He worked on the assumption that this was due to intrinsic similarities and differences in the blood of individuals. He collected samples of blood from his colleagues in the laboratory and mixed them; while some clotted, others did not.



LANDSTEINER, KARL
Austria

Landsteiner was able to show that there were at least three major groups of human blood which varied according to the antigens attached to the outer cover of the red blood cells. Landsteiner labelled the types A, B and O. A fourth group, AB was discovered the following year. This established the pattern for safe blood transfusion. However, it was not until 1907 that the first matching of blood was performed and World War I found widespread use of Landsteiner's discovery.

Landsteiner's discovery added an important chapter to the development of legal medicine, providing admissible evidence in paternity suits and murder trials. Proof that blood types are inherited through specific genes has provided an effective tool for the study of human genetics and anthropology. He also succeeded in transmitting poliomyelitis to monkeys, a fact which led to the future development of poliomyelitis vaccine. Landsteiner's achievement was recognized by his appointment as Professor of Pathology at the University of Vienna. He was dissatisfied with the working conditions here and later in 1923 moved to Rockefeller Institute for Medical Research, New York.

Landsteiner discovered the additional blood groups M and N, and the rhesus factor Rh named after the species of monkey *Macaccus rhesus* in which it was first discovered in 1940. The Rh factor is the basis of a series of events that can occur in the blood of a mother and foetus and result in a condition called *erythroblastosis foetalis,* causing abortion, miscarriage or a dangerous jaundice in the newborn.

Landsteiner's work, in addition to saving countless lives, was one of the cornerstones of immunochemistry. A shy man, he devoted the major part of his adult life to the study of blood. His book *The Specificity of Serological Reactions* published in 1936 is a classic that helped to establish the science of immunochemistry.

Literature

For his vigorous and graphic art of description and his ability to create, with wit and humour, new types of characters.

Lewis, Sinclair, b.—February 7, 1885, Sauk Centre, Minnesota, d.—January 10, 1951, near Rome. A novelist and a social critic who, in an era of intense national self-consciousness after World War I, exposed American complacency with his satirical depiction of emotional shallowness and spiritual void in the Middle Western American life. His attacks were in fact an expression of his intense love for America.

He graduated from the Yale University and for a time worked as a news reporter and as editor for some small publishers. His first novel, *Our Mr. Wrenn* (1914), and *The Trial of the Hawk* (1915), received favourable criticism but were complete commercial flops. But his articles published simultaneously in the *Saturday Evening Post* and the *Cosmopolitan* were very successful. He published the *Main Street* in 1920, which immediately gave him a literary reputation. *Main Street* is seen through the eyes of an Eastern girl married to a Middle Western doctor in Gopher Prairie, Minnesota. She was appalled at the dullness and meanness of provincial life and tried hard to introduce some cultural activities, but the small town folks remained ever obdurate. The force of the book lies in Lewis' careful rendering of local speech, customs and social amenities. The satire is directed to both the towns people and the pseudo-intellectuals of city. *Main Street* thus became not just an ordinary novel but the true portrait of American provincialism and the narrow minded town-life of Mid-western America.

LEWIS, SINCLAIR
USA

In 1922, he published *Babbitt,* a study of the complacent American whose individuality is shadowed by memberships of Rotary clubs, business deals and general conformity. 'Babbitt' came into popular usage to represent the overoptimistic, complacent, self-congratulatory, middle-aged businessmen whose horizons were bounded by the perimeter of his small village. *Babbitt* made a deep impression on the public consciousness and is possibly his best novel. He followed this success with *Arrowsmith* (1925), a satiric study on the medical profession.

His next important book, *Elmer Gantry* (1927), which came out after *Man Trap* (1926), was an attack on the ignorant, crude and vindictive leaders who were dominating the protestant church. *Dodsworth* (1929) depicted the experiences of a big businessman and his wife on European values of life. His later books like *Ann Vickers* (1933), *Work of Art* (1934), *The Prodigal Parents* (1938), *Bethel Meeriday* (1940), *Gideon Planish* (1943), *Class Timberlane* (1945), *The God Seeker* (1949) and *World so Wide* (posthumously, 1951) were not up to the standards of his earlier works. *It Can't Happen Here* (1935) dramatized the possibilities of an imaginary Fascist occupation of America. *Kingsblood Royal* (1947) is a novel on race relations picturizing the story of a Minnesota banker who suddenly discovered that he had a dash of Negro blood and supported the cause of Negroes of his locality.

In his final years he lived most of his time in Europe. His reputation gradually declined after the thirties.

Peace

Söderblom, Lars Olof Nathan, b.—January 15, 1866, Trono, Sweden, d.—July 12, 1931, Uppsala. A Lutheran archbishop and student of comparative religion who received the prize for his international efforts on the maintenance of peace through church unity.

He was influenced by the writings of Albrecht Ritschl, a 19th century Lutheran theologian who stressed social thought, and turned to the original teachings of Luther with new appreciation. He was ordained as a minister in 1893 and served seven years as a chaplain to the Swedish legation in Paris before becoming Professor of Theology at the University of Uppsala. He was also a pro-

SÖDERBLOM, LARS OLOF
NATHAN (JONATHAN)
Sweden

fessor at Leipzig, was appointed archbishop of Uppsala and primate of Sweden. Later travels stimulated his interest in ecumenical activity; as a result of his organizational work the first Universal Conference on life and work was convened in Stockholm in 1925. The series of these conferences established a tradition that later merged with that of the World Council of Churches. He broke new ground in the field of comparative religion with his study and publication of Persian religion, *La Vie future d'apres le Mazdeisme,* 1901 (The Afterlife According to Mazdaism). More significant was his study emphasizing holiness rather than the idea of God as the basic notion in religious thought which was expressed through *Gudstrons uppkomst* (1914); *Das Werden des Gottesglaubens* (1926). Among his other works are *The Living God; Basal Forms of Personal Religion* (1933, Gifford Lectures, 1931) *Humor och melankoli och andra Lutherstudier,* 1919, (Humour and Melancholy and other Luther Studies); and *Christian Fellowship* (1923).

1931

CHEMISTRY

Bosch, Carl / Bergius, Friedrich

PHYSIOLOGY OR MEDICINE

Warburg, Otto Heinrich

LITERATURE

Karlfeldt, Erik Axel

PEACE

Addams, Jane / Butler, Nicholas Murray

1931

Chemistry

In recognition of their contribution to the invention and development of chemical high pressure methods.

Bosch, Carl, b.—August 27, 1874, Cologne, d.—April 26, 1940, Heidelberg. Bosch was the eldest son of an engineer. He did well in science in school and spent a year as a metal worker before going to university. He studied chemistry at Leipzig where he took his doctorate in 1898. In 1899 he got a job with the Badische Anilin und Soda Fabrik (BASF), a very large German chemical company making dyestuffs. He spent much of his time investigating various nitrogen fixation processes from 1902 to 1907.

BOSCH, CARL
Germany

BASF was informed of ammonia synthesis in 1908 by Fritz Haber (Nobel Laureate) and the responsibility for industrial scale synthesis of ammonia by Haber's process was given to Bosch. He designed the massive high-pressure converters and was the first to use the water-gas shift reaction ($CO+H_2O=CO_2+H_2$) to obtain the large volume of hydrogen necessary for the synthesis of ammonia. He thus invented the "Bosch process" for preparing hydrogen on a large scale by passing a mixture of steam and water-gas over a catalyst at high temperature.

Oppau works of BASF, a plant using the Haber-Bosch process, was making 36,000 tons of sulphate of ammonia a year by the end of 1913. Bosch was made Director of BASF in 1914, and in the next few years enlarged Oppau and built a much larger factory at Leuna. In 1918-19 he was technical adviser to the German delegation at the armistice and peace conferences.

Bosch was mainly involved in problems of organization and he supported the synthesis of methanol, and the long and costly development to make petrol by the hydrogenation of coal tar and lignite. He became Chairman of the management board when other German chemical companies merged with BASF in 1925 to form the vast *I.G. Farbenindustrie AG.* Due to ill health he could not take an active part in the affairs of the organization.

Bosch was of a retiring nature, wrote little, and made infrequent public appearances. In recognition of his outstanding work in chemistry, he was awarded a number of honorary degrees. He was awarded the prize jointly with F. Bergius for his work on high-pressure synthesis.

Bosch made loud protests against the Nazis who badly treated his colleague Fritz Haber, who was of Jewish origin. ◆

In recognition of their contributions to the invention and development of chemical high pressure methods.

Bergius, Friedrich, b.—October 11, 1884, Goldschmieden near Breslau, Silesia, d.—March

30, 1949, Buenos Aires, Argentina. His grandfather was Professor of Economics in Breslau, and his father owned a chemical factory in Goldschmieden. Bergius was educated in Breslau, and while still at school took great interest in his father's factory where he was able to study various working methods under the guidance of his father and thus became acquainted with chemico-technical processes and at a very early age obtained considerable insight into industrial as well as scientific matters.

Bergius was sent to the Ruhr for six months before entering the University. Here he studied the practical aspects of a large metallurgical plant and profited greatly by this experience. In 1908 he entered Breslau University to study chemistry. After doing one year's military service he proceeded to Leipzig University in 1905. He completed his thesis *On absolute sulphuric acid as a solvent* in Breslau under Abegg and in 1907 received his degree at Leipzig. He worked for a while at Nernst's Institute in Berlin and then went to Karlsruhe to study under Haber (Nobel Laureate) for one term in 1909. The work which was being carried out there on the chemical equilibrium in gas reactions, in particular that on the synthesis of ammonia, prompted his own research in Hanover in 1909. The equipment available in the laboratories of the Technische Hochschule in Hanover soon proved insufficient and in 1910 Bergius established his own private laboratory in Hanover. In order to maintain this laboratory, in 1914, Bergius took up the job of an executive with the Essen works of the firm Th. Goldschmidt A.G. and also shifted his laboratory there.

BERGIUS, FRIEDRICH
Germany

Bergius worked for a short time in 1911 as a lecturer at the Technische Hochschule in Hanover, which he gave up with the outbreak of World War I. He lived in Berlin from 1914 to 1921. He set up a comparatively large industrial plant for the technical development of the hydrogenating process in Rheinau near Mannheim, which he found insufficient for the large scope of his research work. Bergius hence set out to find firms suitable for collaborating in the development of hydrogenation, which included apart from groups of German companies, Shell Trust and a number of British enterprises, especially the coal industry.

The purpose of the work done by Bergius was to resolve the problem of the manufacture of oils and liquid fuels from solid coal, such as lignite. Hydrocarbons, the products of such a liquefaction of coal were considered necessary to modern living. The process conceived by Bergius, now known as "Berginisation" involves simple distillation of coal with varying degrees of temperatures which can be achieved at higher or lower temperatures. The yield was poorer at higher temperatures and better at low temperatures. In order to get a yield of the greatest possible quantity of oil, Bergius employed a high-pressure method which is the forcing in of hydrogen under high pressure while distillation was taking place at varying degrees of temperature resulting in considerable yield of oil than is possible with conventional distillation of coal. On the basis of the work done by Bergius, a powerful industry had already been formed at that time.

Bergius also researched into the conversion of wood into sugar and of sugar into other food products. This work helped to provide Germany with food materials during World War II. He was also involved in the financing of his scientific developments.

He received the degree of D. Phil. from the University of Heidelberg and the honorary doctorate from the University of Hanover. He was awarded the Liebig medal and was elected to the Board of Directors of many associations and companies interested in coal and oil.

Note: The 1931 prize was awarded jointly to Carl Bosch and Friedrich Bergius.

Physiology or Medicine

For his discovery of the nature and mode of action of the respiratory enzyme.

Warburg, Otto Heinrich, b.—October 8, 1883, Freiburg -im-Breisgau, d.—August 1, 1970, West Berlin. A German bio-chemist who was awarded the prize for his researches on tissue respiration. He completed his study of chemistry in Berlin under Emil Fischer, with a dissertation on the stereo chemistry of leucine. His father, who was a physicist, encouraged him to study physical problems as also radiation. After his chemical training he went to Heidelberg to study medicine.

WARBURG, OTTO HEINRICH
Germany

Since 1913, barring the period as a Cavalry officer in World War I, Warburg worked without interruption at the Max Planck Institute of Cytophysiology in Berlin. Being a pioneer in his area of research, he blazed a new trail not only in the field of ideas but also with regard to experimental procedure and the development of new techniques and apparatus.

Since 1920, he researched on the details of the process by which oxygen is consumed by tissues. He found a family of enzymes called "cytochromes" which had iron containing haeme groups which bound molecular oxygen. In 1932, he isolated the first of the above enzymes (the so-called yellow enzymes) or flavo-proteins which activated the dehydrogenation reaction in cells. In 1935, he discovered that nicotinamide formed part of the co-enzyme nicotinamide adenine dinucleotide which is also involved in dehydrogenation. He also investigated on photosynthesis and found that malignant cells needed less oxygen for survival and growth than normal cells. He discovered coenzymes for which he was again recommended for a Nobel Prize in 1944, but Hitler had declared that Germans could not accept it so he was deprived of the second prize. A later Nobel Laureate, Sir Hans Krebs, was one of his well-known students. Warburg did not marry because he thought that marriage would interfere with his scientific ambitions. He was a strict disciplinarian and an accomplished horseman and a sailor. He showed courage when his principles were threatened.

Literature

The poetry of Erik Axel Karlfeldt.

Karlfeldt, Erik Axel, b.—July 20, 1864, Folkaerna, Sweden, d.—April 8, 1931, Stockholm. A poet whose compositions were essentially based on regional tradition and were extremely popular. His strong ties with the peasant culture of his rural homeland remained a dominant influence on him throughout his life.

KARLFELDT, ERIK AXEL
Sweden

He published his most important work in six volumes of verses: *Vildmarksloch Kaerlkvisor* (1895, Songs of Wilderness and of Love), *Fridolins visor* (1898, Fridolin's Songs), *Fridolins lustgard* (1901, Fridolin's Pleasure Garden), *Flora och Pomona* (1906), *Flora och Bellona* (1918) and, finally four years before his death, *Heesthorn*

(1927, The Horn of Autumn). Some of his poems were published in English in a collection named *Arcadia Borealis: Selected poems of Erik Axel Karlfeldt* (1938).

His admirers criticized him for wasting his talents as a poet only in the service of a decadent local peasant culture. He was a librarian at the Institute of Agriculture in Stockholm and was elected to the Swedish Academy in 1904, later becoming its permanent secretary in 1912. He was offered the Nobel Prize in 1918 but he declined the offer. But in 1931 he was given the award posthumously. "It is the first ever posthumous award of the Nobel Prize because he represents our character with a style and genuineness that we should like to be ours."

Peace

Addams, Jane, b.—September 6, 1860, Cedarville, Illinois, d.—May 21, 1935, Chicago. A social reformer and pacifist, co-winner with Nicholas Murray Butler of the USA of the prize. She is best known as the founder of Hull House, Chicago, one of the first social settlements in North America. After graduation from Rockford College in 1881, she entered the Women's Medical College, Philadelphia, but her health failed and she left her studies. Then she travelled extensively in Europe, visiting the Toynbee Hall settlement house in the Whitechapel district of London. Upon returning to the USA she and her travelling companion, Ellen Gates Starr, determined to create something like the Toynbee Hall. In a working class district in Chicago, in the residence of one Charles Hull, they moved in and named it Hull House. Eventually, the settlement included 13 buildings and a playground, as well as a camp near Lake Geneva, Wisconsin. Many prominent social workers and reformers came to live in the Hull House. Many others lived there to make their living in business or the arts while helping Miss Addams in her settlement activities.

Jane Addams worked with labour and other reform groups for the first juvenile court of law, tenement house regulation, an eight-hour working day for women, factory inspection, and workmen's compensation. She also fought for justice towards the immigrants and the Blacks, advocated research to determine the causes of poverty and crime, and supported women's suffrage. In 1910, she became the first woman president of the National Conference of Social Work, and in 1912 took an active part in the Progressive Party's presidential campaign for Theodore Roosevelt. At The Hague in 1915 she was chairman of the International Congress of Women, following which the Women's International League of Peace and Freedom was established. In 1917 her popularity underwent a temporary decline because of her opposition to the American entry into World War I. Her books include *Democracy and Social Ethics* (1902), *Newer Ideals of Peace* (1907), *Twenty Years at Hull House* (1910), and *The Second Twenty Years at Hull House* (1930).

ADDAMS, JANE
USA

◆

Butler, Nicholas Murray, b.—April 2, 1862, Elizabeth, New Jersey, d.—December 7, 1947, New York City. An educator, publicist, politician and President of Columbia University, Butler was educated at Columbia College, which became his intellectual and occupational home for the rest of his life. There he decided to prepare for a professional career in education. After completing his undergraduate work, he continued at Columbia as a graduate fellow in philosophy, taking his Ph.D. in 1884. He spent a year in Paris and Berlin and completed his formal education. He was appointed an assistant in philosophy at Columbia and became professor of philosophy and education and president of the university in 1901. He held the later post until his retirement in 1945. Under his leadership Columbia grew from a pro-

BUTLER, NICHOLAS MURRAY
USA

vincial college into a university of world repute. As a young man Butler strongly criticized US teaching methods prevalent in his time. As founder and president of the Industrial Education Association he played a central role in the establishment of New York College for the Training of Teachers. Later, he criticized the teaching reform itself, steadfastly defending the "great tradition" in education and lashing out against vocationalism and behaviourism as detrimental factors. Butler was a champion of international understanding and helped to establish the Carnegie Endowment for International Peace, of which he was a trustee and president. He shared the prize with Jane Addams in 1931. He was also president of the American Academy of Arts and Letters.

Note: The 1931 prize was divided equally between Addams and Butler.

1932

PHYSICS

Heisenberg, Werner Karl

CHEMISTRY

Langmuir, Irving

PHYSIOLOGY OR MEDICINE

Adrian, Edgar Douglas

Sherrington, Sir Charles Scott

LITERATURE

Galsworthy, John

1932

Physics

For the creation of quantum mechanics, the application of which has, inter alia, led to the discovery of the allotropic forms of hydrogen.

Heisenberg, Werner Karl, b.—December 5, 1901, Wuerzburg, in West Germany, d.—February 1, 1976, Munich. Son of Dr. August Heisenberg, he went to the Maximilian School at Munich until 1920. He studied at the University of Munich under Sommerfield and obtained his Ph.D. in 1923. He also worked with Born at Göttingen and under Bohr in Copenhagen. He evolved matrix mechanics. His studies on nuclear theory helped him to predict the existence of orthohydrogen and para-hydrogen which was confirmed in 1929. In 1927 he enunciated the famous uncertainty principle which states that it is impossible to make an exact and simultaneous determination of both the position and the momentum of any body. The product of the uncertainties of the two determinations yielded the value of universal constant named after Planck. Heisenberg's uncertainty principle destroyed the purely deterministic philosophy of the universe.

HEISENBERG, WERNER KARL
Germany

After the discovery of the neutron in 1932 by Chadwick, Heisenberg maintained that the protons and neutrons would be held together in the confines of the nucleus by means of exchange forces, which were later worked out by Yukawa.

He was also to work under Nazis and during World War II he was in-charge of German research on atomic bomb. He was director of Max Planck Institute of Berlin and later at Göttingen. In 1927, he published his uncertainty principle, upon which he built his philosophy and for which he is best known. From 1927 to 1941 he was professor at the University of Leipzig. For the following four years he was director of the Kaiser Wilhelm Institute for Physics in Berlin.

Heisenberg took great interest in classical music and was himself a distinguished pianist. He married Elisabeth Schumacher in 1937; they had seven children.

Chemistry

For his discoveries and investigations in surface chemistry.

Langmuir, Irving, b.—January 31, 1881, Brooklyn, New York, USA, d.—August 16, 1957, Falmouth, Massachusetts, USA. He was the third boy in a family of four sons. A child prodigy, he was inspired by his brother Arthur, elder to him by nine years, to participate in experiments on chemical substances at the age of six. Irving was only thirteen, when his mother already declared, "Irving is a born scientist, and he certainly ought to make his mark in the world"

After studying metallurgical engineering at the Columbia University, he worked under Walther

Nernst, at the University of Göttingen, where he took his Ph.D. in 1906. He was generally acknowledged to be a superb teacher, but his career as a College Professor was a nightmare for him. Through a friend he heard about the General Electric Research Laboratory, Schenectady, New York, and joined them for a summer job in 1909. He stayed there for the rest of his life till 1950 (41 years) as an active researcher and as a consultant for remaining seven years of his life.

LANGMUIR, IRVING
USA

Investigating electrical discharges in gases, electron emission and the high-temperature surface chemistry of tungsten, Langmuir greatly extended the life of the tungsten-filament light bulb. He also developed a vacuum pump, high-vacuum tubes used in radio broadcasting, and an atomic hydrogen blowtorch capable of attaining temperature comparable to those of the sun's surface. His inventions resulted in 63 patents. He considered the patent system the foundation of free enterprise in the United States.

Working independently of the US atomic chemist Gilbert N. Lewis, Langmuir formulated theories of atomic structure and chemical bond formation and introduced the term "covalence". In 1946, he and his associates began to explore the possibility of inducing rainfall by seeding clouds with silver iodide and solidified carbon dioxide.

He was a ceaseless worker and was greatly influenced by Louis Pasteur. Albert Rosenfeld, Langmuir's finest biographer, has movingly explained: "Louis Pasteur had brought to the common people, as no savant before him had done, an awareness of the worth of science; and he died acclaimed universally as a benefactor of humanity, and as one of the great men of all time.....The pomp and grandeur of the funeral rites, and the hushed reverence of the Parisian populace as the Minister of public education delivered the eulogy in the great Cathedral square, enabled Irving to assume himself that science was not only more fun than anything, but also the highest and noblest calling of them all."

Physiology or Medicine

For their discoveries regarding the functions of neurons.

Adrian, Edgar Douglas, b.—November 30, 1889, London, d.—August 4, 1977, London. An electrophysiologist who with Sir Charles Scott Sherrington won the prize for discoveries regarding the nerve cell. He was the son of a lawyer.

Adrian graduated in medicine in 1915 from Trinity College, Cambridge. After medical service during World War I, he spent the greater part of his professional life at Trinity College.

ADRIAN, Lord EDGAR DOUGLAS
Great Britain

Adrian did research on nerve impulses from sense organs, amplifying variations in electrical potential and recording smaller potential changes than had been detectable previously. Later he recorded nerve impulses from single sensory endings and from single motor nerve fibres, measurements contributing to a better understanding of the physical basis of sensation and the mechanism of muscular control. Adrian studied the electrical activity of the brain; his work on the variations and abnormalities of the changes, already known as the "Berger rhythm" after Hans Berger, opened up new fields of investigation in epilepsy and in the location of cerebral tumours.

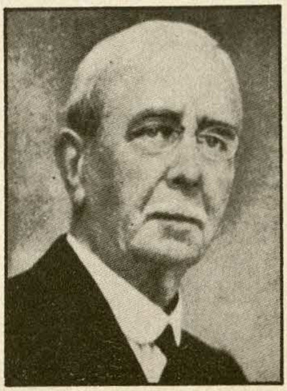
He was president of the Royal Society (1950-55) of which he had been Foulerton Professor (1929-37). In 1942, he was awarded the Order of Merit and in 1955 a barony.

Among his writings are *The Basis of Sensation* (1927), *The Mechanism of Nervous Action* (1932) and *The Physical Background of Perception* (1947).

◆

For their discoveries regarding the functions of neurons.

Sherrington, Sir Charles Scott, b.—November 27, 1852, London, d.—March 4, 1952, Eastbourne, England. An English neurologist noted for his studies on reflex action. In 1932, he received (with E.D. Adrian) the prize for discoveries regarding the function of neurons. He was educated at Gonville and Caius College, Cambridge. After receiving his B.A. (1883) with a first class honours in natural sciences he studied medicine at St. Thomas Hospital Medical School, London, and received M.B. degree in 1885. For some time he worked with Robert Koch in Berlin. After conducting research on epidemic cholera in Spain and Italy, he became a fellow of Caius College and Lecturer at St. Thomas Hospital (1887-93). In 1891, Sherrington became Brown professor of Pathology, London, and superintendent of the Brown Animal Sanatory Institution when he succeeded Victor Horseley, the noted British neurosurgeon; in 1895, Holt professor of physiology, Liverpool; and was Waynflete professor of physiology at Oxford (1915-35), retiring in 1936. He also held the Fullerian chair of physiology at the Royal Institution, 1914-17. He was made a fellow of the Royal Society in 1893, he served as its president 1920-25. He was knighted in 1922. While at Caius College, he investigated the anatomy of nerve paths between the brain and the spinal cord. Later he turned to the physiology of the spinal cord after isolation from the brain and proved the presence of sense organs in skeletal muscles, thus ending the ancient controversy about "muscle sense". Next, he showed how complex was spinal reflex action in the "scratch reflex". He suggested that the liability of reflex nerve centres came from physicochemical states in the points of contact between nerve cells, which he called "synapses". His Silliman lecture at Yale in 1904 was published as *The Integrative Action of the Nervous System* (1906; reprinted, 1947) which became a standard work and established his worldwide reputation, marking out new fields for physiological researches.



SHERRINGTON, Sir CHARLES SCOTT
Great Britain

Note: The 1932 prize was divided equally between Adrian and Sherrington.

Literature

For his distinguished art of narration which takes its highest form in 'The Forsyte Saga'.

Galsworthy, John, b.—August 14, 1867, Kingston Hill, Surrey, d.—January 31, 1933, Grove Lodge, Hampstead. A novelist and playwright of distinction, he was born in a farmer family from Devonshire. They were landowners and well known from the 16th century. His father was a solicitor. Galsworthy was educated in Harrow and the New College, Oxford, and was called to the bar in 1890. He wanted to specialize in Marine law so he undertook a voyage around the world. But instead of practising law he gradually took to writing.

For his first works, *From the Four Winds* (1897), a collection of short stories, and the novel

GALSWORTHY, JOHN
Great Britain

Jocelyn (1898) he used his pseudonym "John Sinjohn". The *Island Pharisees* (1904) was his first book with his real identity. His most famous work, *The Forsyte Saga*, began as a novel. *The Man of Property* (1906) and others in the same series of Forsyte Saga were, *Indian Summer of a Forsyte* (1910, in five tales), *Chancery* (1920), *Awakening* (1920) and *To let* (1921). The anecdote of the Forsyte family after World War I was continued in *The White Monkey* (1924), *The Silver Spoon* (1926) and *Swan Song* (1928); those were collected in a book called *Modern Comedy* (1929). Some of his later works also had reference to the Forsyte family. His other novels include, *The Country House* (1907). *The Patrician* (1911), *The Dark Flower* (1913) and *The Freelands* (1915).

He was also a successful dramatist, his dramas include, *The Silver Box* (1905), *Strife* (1909), *Justice* (1910), *A Ageon* (1912), *A Bit o'Love* (1915), *The Skin Game* (1920) and *Loyalties* (1922), *The Forest* (1924) and *The Show* (1925). His works were accepted as a pattern of English life because they were devoid of complicated psychology and reflected simple ideas.

His reputation is due to the *Forsyte Saga*, the history of a large English family similar to his own which had risen to wealth and success in professional as well as business world. A part of *Forsyte Saga* was filmed as the Forsyte Woman, and it was a successful depiction. He refused the offer of knighthood in 1917. With the prize money he started a Trust Fund for PEN of which he was founder president.

1933

PHYSICS

Dirac, Paul Adrien Maurice
Schrödinger, Erwin

PHYSIOLOGY OR MEDICINE

Morgan, Thomas Hunt

LITERATURE

Bunin, Ivan Aleksejevic

PEACE

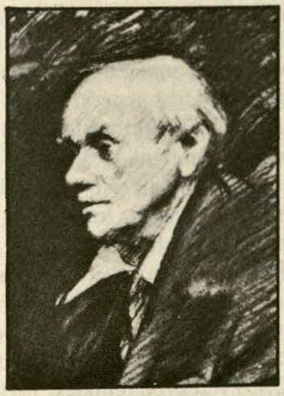
Angell (Ralph Lane), Sir Norman

1933

Physics

For the discovery of new productive forms of atomic theory.

Dirac, Paul Adrien Maurice, b.—August 8, 1902, Bristol, England, d.—October 21, 1984, Tallahassee, USA. Born of Swiss father and English mother, he was educated at the Merchant Venturer's Secondary School, Bristol, before joining Bristol University. He graduated with electrical engineering in 1921 and studied mathematics for two years. He received his Ph.D. in Mathematics in 1926 from St. John's College, Cambridge. He taught at Cambridge after receiving his doctorate and in 1932 was appointed Lucasian Professor of Mathematics. In 1926, while still a graduate student, he made his first major contribution to physics by devising a form of quantum mechanics. Later, he put forward a theory that predicted electron spin and the existence of a fundamental particle, the *positron.* Dirac introduced a quantum theory of radiation and was co-inventor of the "Fermi-Dirac Statistics". In 1933 he was awarded the prize along with Schrödinger for his theory of anti-particles, and in 1939, he received the medal of the Royal Society of England. He made a major contribution to physics by devising a new version of quantum mechanics noted for its generality and simplicity.



DIRAC, PAUL ADRIEN MAURICE
Great Britain

Dirac travelled extensively and studied at various foreign universities. In 1937, he married Margit Wigner.

◆

For the discovery of new productive forms of atomic theory.

Schrödinger, Erwin, b.—August 12, 1887, Vienna, d.—January 4, 1961, Vienna. He was the only son of Rudolf Schrödinger and went to University of Vienna from 1906 to 1910. He served as an artillery officer during World War I.

A theoretical physicist who contributed to the fundamentals of quantum mechanics by discovering its basic equation, Schrödinger's early career was spent at the University of Vienna until 1920. He taught at Zuerich and then succeeded Max

SCHRODINGER, ERWIN
Austria

Planck as professor of theoretical physics at the University of Berlin (1927-33). In 1926 while at Zuerich he developed the wave equations that describes the behaviours of electrons and other sub-atomic particles. This laid the foundations of the so-called wave-mechanics which gave a firm mathematical basis for the quantum theory developed by Planck. For that work, he won the prize jointly with Dirac. Schrödinger settled in Dublin (1940-56), where he did research in physics and in the history and philosophy of science and published *What Is Life?*, an application of quantum mechanics to genetics, and *Nature and the Greeks,* on ancient Greek science and philosophy. He retired to Vienna in 1956, where he wrote *Meine Weltansicht* (1961, My View of the World, 1964).

Schrödinger always found it difficult to work with others, even his own pupils. Many remember him for his strange habit of carrying his belongings in a rucksack. He married Annemarie Bertel in 1920 who became his faithful companion.

Note: The 1933 prize was divided equally between Dirac and Schrödinger.

Physiology or Medicine

For his discoveries concerning the role played by the chromosome in heredity.

Morgan, Thomas Hunt, b.—September 25, 1866, Lexington, Kentucky, d.—December 4, 1945, Pasadena, California. A geneticist and embryologist, he graduated from the University of Kentucky. He is famous for his experimental research with the fruit fly *(Drosophila)* and establishment of the chromosome theory of heredity.

MORGAN, THOMAS HUNT
USA

Morgan showed an interest in natural history early in life. He studied biology at the University of Kentucky and earned a doctorate in zoology in 1890 from Johns Hopkins University. He was Associate Professor of Zoology, Bryn Mawr (1891-1904), Professor of Experimental Zoology, Columbia University (1904-1928) and Professor of Biology at the California Institute of Technology, Pasadena (1928-45).

Morgan's curiosity of nature arose at a very young age and he started collecting fossils, birds' eggs and birds even before he was ten. He started his career as an embryologist and through some brilliant experiments on frog's eggs put an end to the idea that the egg was a mosaic or collection of hereditary pieces. Since shifting to Columbia in 1904, as a professor of experimental biology, he began investigating Mendelian laws. He was initially very skeptical about some of the Mendelian findings and in fact had endorsed an attack on the Mendelian law of purity of the gametes by the scientist Oscar Riddle. His attention at that time was drawn to *Drosophila,* the common fruit fly as an experimental material by F.E. Lutz. The little flies grew from egg to maturity in 8 to 12 days and had distinct, easily observable traits which made it an ideal genetic tool.

The first major breakthrough was Morgan's observations of a mutant "white eye" as against the normal red eyes in his one-year-old "pedigree culture" Morgan bred the lone white eyed fly to one of the red eyed females and in very short order he had 1,237 red eyed offsprings. These hybrids were exhibiting only the dominant red eye colour in accordance with Mendel's laws. When these hybrids were inbred, however, he observed 2,459 red eyed females, 1,011 red eyed males, and 782 white eyed female amongst the progeny. Morgan rightly speculated that the gene for the white eyes were linked with male chromosomes of Drosophila.

This was the beginning. Part of the success story of Morgan was his ability to surround himself with able collaborators and students. The "fly squad", as they were called, studied inheritance of more than a hundred characters and proved beyond doubt that characters in Drosophila were inherited not only in linked pairs, but also in linked groups.

More and more characteristics appeared, some of which did not go with the sex group. Morgan and his group carefully charted four graphs of characters that pertained to four pairs of chromosomes that *Drosophila* possessed. In 1911, in a short communication to *Science,* he presented the chromosome theory of inheritance, according to which the extént of recombination obtained between genes on the same chromosome is a measure of their spatial separation. Mendel's hereditary unit has at last been pinned to the chromosomes by one of his skeptics, Morgan.

Further research led him to the conclusion that the genes are arranged in linear order in the chromosomes. Morgan and his principal associates A.H. Sturtevant, H.J. Müller, and C.B. Bridges used a map of Drosophila's chromosomes in their book *The Mechanism of Mendelian Heredity.* It was a curious map, where on the straight lines representing one of Drosophila's chromosomes, places were marked for "yellow", "white", "miniature", "sable", "cleft" and "bobbed" —the colourful and descriptive names for the genes. Morgan and his group has conclusively demonstrated Mendel's laws of inheritance, which laid the foundations of modern genetic studies.

Morgan was elected fellow of the Royal Society and received the Darwin Medal in 1924.

Morgan was a very active researcher and prolific writer. He returned to his embryological research work towards the later part of his life. Amongst the many students he inspired was H.J. Muller an eminent geneticist and a Nobel Laureate himself.

Literature

For the strict artistry with which he has carried on the classical Russian traditions in prose writing.

Bunin, Ivan Aleksejevic, b.—October 23, 1870, Voronezh, Russia, d.—November 8, 1953, Paris. A poet and a novelist and one of the best writers of the 20th century. He initially worked as a journalist and a clerk and later changed to writing and translating poetry.

He published his first volume of verse in 1891, and *Listopad* (The Fall of the Leaf, 1898) was favourably received. For his translation of Longfellow's *Hiawatha* he was awarded a Pushkin Prize in 1903 by the Russian Academy of which he was also elected a fellow in 1909. He also translated Byron's *Manfred and Cain.* His poems had a Paranassian influence and belonged to the post-Pushkin tradition.

BUNIN, IVAN ALEKSEJEVIC
USSR and France

He became well-known as a short story writer with such works as *Gospodin iz San Fransisko* (1916, The Gentleman from San Fransisco, 1922). His last book of short stories was, *Tyomnye alley* (1943, Dark Avenues, 1949).

His later works include *Derevnya* (1910, The Village, 1923), *Sukhodol* (1911-12), *Mitina lyubov* (1925, Mitina's Love, 1926), *Zhizn Arsenyeva* (The Life of Arsenev, 1930), a fictional autobiography *Istoki dne'y* (1930, The Well of Days, 1933) and its sequel, *Linka* (1939) and the two volumes of memoirs, *Okajannye dni* (1926, The Cursed Days) and *Vospominaniya* (1950, Memories and Portraits, 1951). He also wrote a book on Leo Tolstoy, *Osvobozhdeniye Tolstogo* (1937, Tolstoy's Liberation) and also wrote on Anton Chekov, both were known to him personally. The latter work *O Chekove,* (1955), was published two years after his death.

Peace

Angell (Ralph Lane), Sir Norman, b.—1874. A British journalist, he had spent several years in the United States, where he was struck by the animosity towards England which was fostered in

ANGELL (RALPH LANE), Sir NORMAN
Great Britain

many quarters.

Norman Angell made it his prime duty from that moment to create public opinion, both in his own and other countries, more resistant to nationalistic influences by subjecting these phenomena to a clear analysis which would help people to consider these problems with more commonsense. From 1905, he worked in Paris as editor of the Continental edition of the *Daily Mail,* and in 1909 he published a pamphlet entitled *Europe's Optical Illusion.* The main ideas in this were further developed in his book, *The Great Illusion,* which was published in 1910 and in a very short time ran through several editions, and was translated into a number of languages. In this book Angell raised the question of what benefits war might bring. He took as a concrete example the possibility of a war between England and Germany. Angell regarded the increasing interdependence of nations as a significant factor in the prevention of animosity. It is as an agitator that he has been very important, and the award of the prize for Peace was due to the fact that many of his basic ideas proved to have surprising reality and could be applied to the problems of the inter-war years.

1934

CHEMISTRY

Urey, Harold Clayton

PHYSIOLOGY OR MEDICINE

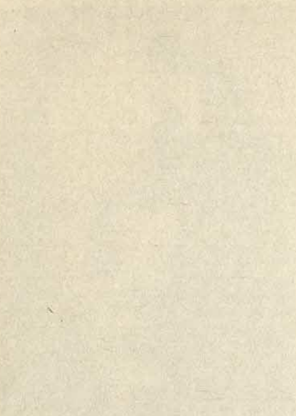
Minot, George Richards
Murphy, William Parry
Whipple, George Hoyt

LITERATURE

Pirandello, Luigi

PEACE

Henderson, Arthur



1934

Chemistry

For his discovery of heavy hydrogen.

Urey, Harold Clayton, b.—April 29, 1893, Walkerton, Indiana, d.—January 5, 1981, La Jolla, California. Urey originally graduated from the University of Montana in 1917 with a degree in zoology. After a brief spell as a chemist he was with the universities of Montana and California doing research in chemistry. He began his scientific career as an American Scandinavian Foundation Fellow in Copenhagen (1923-24) where he took part in the basic research of Niels Bohr pertaining to atomic structure. On his return he was associated with various noted universities like Johns Hopkins University (1924-1929) and Columbia University (1934-45). He was appointed Professor of Chemistry at the Institute for Nuclear Studies at the Chicago University (1945-58). During this time, he spent a year (1956-57) in Oxford as George Eastman Visiting Professor. He was made Professor Emeritus of the University of California at La Jolla and joined the Space Science Board in 1958 under the US National Academy of Science.

O. Stern and M. Volmer in 1919 were looking for a heavy isotope of hydrogen to account for the small increase in the atomic weight from exact unity. Urey, with G. Brickwedde and G.M. Murphy, made a determined search for this isotope by the controlled evaporation of liquid hydrogen from four litres to one millilitre. Spectroscopic examination of the residue showed a clear line corresponding to deuterium, the mass 2 isotope. Urey with E.W. Washburn developed a method of preparing deuterium by the electrolytic decomposition of water, based on the fact that the lighter isotope is evolved marginally more rapidly. He prepared a number of compounds where deuterium was present instead of hydrogen. These helped in the establishment of the isotope labelling techniques, which have proved very valuable in modern chemistry.

UREY, HAROLD CLAYTON
USA

Urey was responsible for the development of the first atomic bomb. His later work also involved the distribution of isotopes in relation to the origin of the universe and of life on earth. This was published in 1952 as a stimulating book, *The Planets: Their Origin and Development.* He also contributed to the study of the lunar surface. He offered a new theory on meteorite formation, and made strong recommendations for space exploration. He received the Davy Medal in 1940, and was elected Foreign Member of the Royal Society in 1947.

Physiology or Medicine

For their discoveries concerning liver therapy in cases of anaemia.

Minot, George Richards, b.—December 2, 1885, Boston, d.—February 25, 1950, Brookline. A physician who received with George Whipple and William Murphy the prize for the successful introduction of a raw-liver diet in the treatment of pernicious anaemia. As a member of the research staff at the Massachusetts General Hospital, he investigated blood disorders; and, as the physician in chief at the Collins P. Huntigton Memorial Hospital, Harvard University, and associate in medicine at the Peter Bent Brigham Hospital, Boston, he worked with Murphy to find the causes of pernicious anaemia, a deadly disease at that time.

MINOT, GEORGE RICHARDS
USA

Whipple had shown that anaemia in dogs, induced by excessive bleeding, is reversed by administration of raw liver. In 1926, Minot and Murphy found that ingestion of half a pound of raw liver a day reverses pernicious anaemia in human beings. With the American chemist Cohn, Minot succeeded in preparing effective liver extracts which taken orally, constituted the treatment for pernicious anaemia. In 1948, a therapeutic anti-anaemic factor was isolated from liver extract and named Vitamin B_{12} (cyanocobalamine).

It has been discovered that persons suffering from pernicious anaemia lack a substance in their gastric juice which facilitates the body to assimilate the Vitamin B_{12} from a normal quantity of digested meat. The last assignment of Minot was as the director of the Thorndike Memorial Laboratory in Boston City Hospital. ◆

For their discoveries concerning liver therapy in cases of anaemia.

Murphy, William Parry, b.—February 6, 1892, Stoughton, Wisconsin. A physician who with Minot reported in 1926 success in the treatment of pernicious anaemia with a liver diet. Their discovery culminated in Vitamin B_{12} therapy in 1948, by which a previously fatal disorder became amenable to treatment and cure. The Minot-Murphy research was suggested by Whipple's demonstration that liver is essential for blood formation in animals. In 1934, the prize was awarded jointly to the three of them.

MURPHY, WILLIAM PARRY
USA

Murphy received his M.D. from Harvard University (1920). Following a hospital appointment at Providence, Rhode Island, and medical practice in Boston, he became consultant in haematology at the Peter Bent Brigham Hospital in Boston and also taught at Harvard. His textbook *Anemia in Practice* was published in 1939. ◆

For their discoveries concerning liver therapy in cases of anaemia.

Whipple, George Hoyt, b.—August 28, 1878, Ashland, New Hampshire; d.—February 1, 1976, Rochester, New York. Whipple came from a medical family and took his under-graduate degree at Yale University before entering the Johns Hopkins University Medical School in 1901. He was a student of the US Pathologist Welch at the Johns Hopkins University. After graduation in 1905, he remained in Welch's Department of Pathology for two years. He studied many tropical diseases such as amoebic dysentry, filariasis and blackwater fever for a year before returning to Johns Hopkins. In 1914, he married Katherine Ball Waring; they had one daughter and one son.

WHIPPLE, GEORGE HOYT
USA

As Professor of Research Medicine and Director of the Hooper Foundation for Medical Research at the University of California, San Francisco, where he also served as Dean of the Medical School, he demonstrated that liver as a dietary factor greatly enhances haemoglobin regeneration in dogs. He developed with Frieda Robbins an experimental model whereby fixed quantities of blood were removed from dogs, and the influence of various diets in the regeneration of blood cells was studied. They found that liver played the most effective role in stimulating the bone-marrow to produce new red blood cells. In 1918 C.W. Hooper had suggested that liver extract was effective in the treatment of pernicious anaemia in human beings, which was not noticed then. But with the announcement of Whipple's reports, George Minot and William Murphy of Harvard began investigation into the use of liver and other food stuffs in the treatment of pernicious anaemia. Their work led to the effective liver therapy for pernicious anaemia.

At the University of Rochester, New York, he served as Professor of Pathology and as the first Dean of the School of Medicine and Dentistry, Whipple carried out experiments in artificial anaemia, which also established iron as the most potent inorganic factor involved in the formation of red blood cells and haemoglobin. He made important contributions to our knowledge of the blood proteins, to the mechanism of blood-clot formation and to the pathology of thalassemia (disease named by Whipple), a genetic disorder which leads to anaemia and other sequelae, found in people of Mediterranean origin.

Whipple was a Trustee of the Rockefeller Foundation during 1927-43, and a member of the Board of Trustees of the Rockefeller Institute during 1939-60.

Note: The 1934 prize was awarded jointly to Whipple, Minot and Murphy.

Literature

For his bold and ingenious revival of dramatic and scenic art.

Pirandello, Luigi, b.—June 28, 1867, Agrigento, Sicily, d.—December 10, 1936, Rome. A novelist and story writer, he first studied science and then shifted to classics. He went to study philology first at the University of Rome and then at Bonn. He graduated from Bonn by writing his doctoral thesis in German on the dialect of his native Agrigento, and was appointed there as a lecturer in Italian languages. He eventually returned and taught for many years at the Instituto Superiore di Magistero in Rome. In his short stories and novels, he described a deranged and hallucinatory world which reflected the profound moral crisis undergone by the Italian society as aftermath of World War I. His experience was complementary

PIRANDELLO, LUIGI
Italy

to the political experience of D'Annunzio. The fatalism of the characters exposed in the fiction *Verge* comes to be replaced by Mattia Pascal's openness to experience. Serafino Gubbio's split personality or the fragmented personality of Viangelo Moscarda are revealed in *Unò, nessuno e centomila* (1925-26, One, none and a hundred thousand, 1937).

The literary world owes Pirandello for the first theoretical discussion of Italian humours. Among his most significant works are *L'esclusa* (The Outcast, 1893), *I vecchi e i giovani* (The Old and the Young, serialized 1906-08), *Si gira!* (Shoot, 1915), *Il fu Mattia Pascal* (1904), his first European success and it was translated in many languages, *Novelle per un anno* (1922-37, Stories), *Penasaci Giacomino* (Play, 1916), *Liola* (1904), *Il berretto a sonagli* (1916), *L'uomo, la bestia, e la virtu* (Man, Beast and Virtue, 1919), *Il giuocò delle parti* (Rules of the Game, 1919) and *Come to mi vuoi* (1930).

His two greatest plays are *Sei personaggi in cerca d' autore* (1921, Six Characters in Search of an Author) and the *Enrico IV* (1922, Henry IV). The former has been translated in many languages including Bengali and successfully played at Calcutta. In 1925, Pirandello became artistic director of Teatro d' Arte di Roma. His later plays were not very successful. He wrote his first play at the age of 45.

Peace

Henderson, Arthur, b.—1863, d.—1935. The Nobel Prize for Peace in 1934 was given to an Englishman, Arthur Henderson. He represented socialistic ideas amongst the prize-winners. He rose from the working class and had won his credits in the trade union movement. He was elected to the Parliament as a Liberal in 1903, and became parliamentary leader of the Labour Party a few years later. During World War I, he supported England's entry into the war and, in 1915, became a member of Lloyd George's coalition government. In 1917, he was sent to Russia to urge the new revolutionary government to continue the war. But at the same time he was preoccupied with constructive peace aims which a Socialist Party would have to envisage, and his willingness to attend the Socialist Congress in Stockholm in 1917 led to his difference with Lloyd George. In the same year he published a pamphlet, *The Aims of the Labour Party*, in which he forecast great revolutionary upheavals after the war, and appealed to the nations of the Western World to give democracy a honest trial by means of social reforms and by adhering to a system of international security.

Immediately after the war, Henderson associated himself with pacifist line of action. In 1924, he took up the office of the Home Secretary. He strove to direct Great Britain's foreign policy according to the principles of the League of Nations.

HENDERSON, ARTHUR
Great Britain

In 1931, Henderson was elected president of the Disarmament Conference in Geneva. Despite his resignation from the Government he remained the President of the Disarmament Conference. The reason was that he interpreted his election as a personal mark of trust on him, quite independent of his position as the British Foreign Secretary.

1935

PHYSICS

Chadwick, Sir James

CHEMISTRY

Joliot, Frederic / Joliot-Curie, Irene

PHYSIOLOGY OR MEDICINE

Spemann, Hans

PEACE

Von Ossietzky, Carl

1935

Physics

For his discovery of the neutron.

Chadwick, Sir James, b.—October 20, 1891, Bollington, near Macclesfield, England, d.—July 24, 1974, Cambridge. James Chadwick attended Manchester Grammar School before entering the University of Manchester in 1908 where he graduated in physics in 1911. He worked on radioactivity under Sir Ernest Rutherford (Nobel Laureate for Chemistry 1908) for his M.Sc. from 1911 to 1913, and then under H.W. Geiger at the *Technische Reichsanstalt* in Berlin. During the War he had to go underground and even lived in a stable in a racecourse in Ruhleben, near Spandau. He continued his work in physics even during the War with financial help from England and the support of Max Planck (Nobel Laureate for Physics 1918), H.W. Nernst (Nobel Laureate for Chemistry 1920) and Lise Meitner in Germany. He got the Wollaston Studentship at Gonville and Caius College, Cambridge, in 1919, was elected Fellow of the College in 1921 and appointed assistant director of the Cavendish Laboratory for Experimental Physics in 1923. In the Cavendish Laboratory, under Sir Ernest Rutherford he did research on the artificial disintegration of elements under bombardment with alpha particles. Working on Rutherford's intuition Chadwick found that when beryllium was exposed to bombardment by alpha particles, it released an unknown radiation which in turn ejected protons out of the hydrogen-rich paraffin. He interpreted this radiation as being composed of particles of mass approximately equal to that of the proton but without having any electrical charge which he called "neutrons". His interpretation clarified the change effects observed by the Joliot-Curies during a similar experiment. From data or experiments with different targets, he could calculate the mass of the neutron and found that it has slightly more than a proton. Chadwick's discovery provided a new method of atomic disintegration, as neutrons, being neutral, are not deflected by electric fields and therefore are particularly effective in penetrating and probing the atomic nucleus. The study of neutrons soon led to the discovery of nuclear fission and the first nuclear reactor.

CHADWICK, Sir JAMES
Great Britain

Chadwick was elected fellow of the Royal Society in 1932, awarded the Huges Medal for his discovery of the neutron, for which work he received the prize. He was Lyon Jones Professor of Physics at the University of Liverpool during 1935-48 and was knighted in 1945. He headed the British team of technical experts to the USA in 1943 which led to the development of the atomic bomb but returned, in 1946, a changed man. After War, although he participated in the development of nuclear energy in Britain, he believed that fundamental research in nuclear physics should be undertaken in universities and objected to Cockroft heading a government laboratory for such research at Harwell. He became Master of Gonville and Caius College in 1948 but resigned in 1958. He faced temporary financial setback while at this college and after retirement settled in North Wales only to return to Cambridge with Lady Chadwick to live with their twin daughters.

In 1925, Chadwick married Aileen Stewart-Brown; they had twin daughters. Among his hobbies were gardening and fishing.

Chemistry

In recognition of their synthesis of new radioactive elements.

Joliot, Frederic, b.—March 19, 1900, Paris, d.—August 14, 1958, Paris. Son of a Paris merchant, Frederic Joliot studied at the Paris *Ecole de Physique et Chimie.* He studied engineering and chemistry and after a few months as production engineer with a steel company, he entered the Radium Institute at Paris in 1925, as a research assistant to Marie Curie. Although fascinated by the research in which he was involved, Frederic found himself more interested in Madam Curie's daughter Irene who was also an assistant. They married in 1926 and set up a working partnership. He changed his name to Joliot-Curie after marriage. Joliot obtained his doctorate in 1930 on a study of the electro-chemistry of the radio elements. He was appointed to a new chair of Nuclear Chemistry at the College de France in 1937 and after World War II in which he played an important part in the French Resistance, he became the head of the new *Commissariat a l'Energie Atomic* 1946-50. In 1956, he became head of the Radium Institute.

In 1931, Joliot and Irene began their research that culminated in 1934 with their historic discovery, creating almost by chance the first man-made radioactive element for which they were awarded the prize. Joliot described the crucial experiment as follows: "We bombarded aluminium with alpha rays (the heavy nucleus of a helium atom made of two protons and two neutrons) then after a certain period of irradiation, we removed the source of alpha rays. We now observed that the sheet of aluminium continued to emit positive electrons over a period of several minutes." When they examined the target more carefully they found that it no longer consisted entirely of aluminium. Some of the original metal had been transmuted into phosphorus. They observed that the nucleus of the phosphorus atoms contained many more neutrons than natural, making it much heavier, unstable and consequently radioactive. The bombarding of boron produced radioactive nitrogen and of magnesium yielded radioactive silicon. Thus they produced the first example of man-made radioactivity and also proved conclusively that not only heavy elements such as uranium were radioactive, but also any element could be made so by converting it into a radioisotope.

JOLIOT, FREDERIC
France

The significance of their work was that it produced the first clear chemical evidence for transmutation and opened the door to a virtually new discipline. Soon large numbers of radioisotopes were created, and they became indispensable tools in various branches of science. Dramatic confirmation of Joliot-Curie's discovery was provided when he realized that the cyclotron at the laboratory of Ernest Lawrence in California would have been producing artificial elements unwittingly. He cabled them to switch off their cyclotron and listen. To their surprise the Geiger counter continued clicking away, registering for the first time the radioactivity of nitrogen-13.

In 1939 Joliot was quick to see the significance of the discovery of nuclear fission by Otto Hahn. He confirmed Hahn's work and saw the likelihood of a chain reaction. He further realized that the chain reaction could only be produced in the presence of a moderator to slow the neutrons down.

A good moderator was the heavy water that was produced on a large scale only in Norway at Telemark. One of the vital keys both to the building of nuclear reactor and the first atomic bomb was the preparation of heavy water in which hydrogen atom is replaced by its heavier isotope, deuterium. With considerable foresight Joliot managed to persuade the French Minister of Armaments to obtain the entire stock of heavy water, 185 kilograms in all, and to arrange for its shipment to England out of the reach of the advancing German army. Violently opposed to the Nazis, the Joliot-Curies were determined not to allow any information on nuclear research to fall into enemy hands.

During the War Joliot remained in France, pursuing scientific work on biological aspects of isotopes and playing an active part in the French Resistance Movement. After the War, he devoted himself to the reorganization of French science and establishment of a French atomic energy industry. He was a member of the French Communist Party and for this reason he was relieved of his post of High Commissioner for Atomic Energy. He returned to the *College de France*, and, after his wife's death in 1956, succeeded her to the Chair at the Sorbonne. Despite his past achievements and heroic war efforts, he was largely ignored by the scientific establishment.

Joliot's devotion to science was accompanied by an outspoken dislike of many traditional institutions and deep concern for world peace. He was the first President of the World Federation of Scientific Workers and of the World Council for Peace. He also played an active part in the formation of the UN Atomic Energy Commission and UNESCO.

◆

In recognition of their synthesis of new radioactive elements.

Joliot-Curie, Irene, b.—September 12, 1897, Paris, d.—March 17, 1956, Paris. Irene Curie was the daughter of Pierre and Marie Curie, the discoverers of radium. She received little formal schooling, attending instead informal classes where she was taught physics by her mother, mathematics by Paul Langevin, and chemistry by Jean Baptiste Perrin. She later attended the Sorbonne although she first served as a radiologist at the front during World War I. In 1921 she began work at her mother's Radium Institute with which she maintained her connection for the rest of her life, becoming its Director in 1946. She was also a Professor at the Sorbonne from 1937.

JOLIOT-CURIE, IRENE
France

In 1926 Irene Curie married Frederic Joliot and took the name Joliot-Curie. W. Bothe and H. Becker detected a penetrating radiation, ten times stronger than any other radiation from beryllium. Their result was confirmed by Irene Joliot-Curie. With her husband, she showed that this radiation could eject protons from paraffin wax and other hydrogen containing substances. The Joliots very nearly discovered the neutron. However, they went on to make important studies of the materialization of photons and the annihilation of positrons on encounter with electrons.

In 1934, the Joliot-Curies made their historic discovery, creating almost by chance, the first man-made radioactive element, for which they were awarded the prize. They made important studies of the materialization of photons and the annihilation of positrons on encounter with electrons. They observed that aluminium continued to emit positrons after the alpha particle bombardment had ceased. They concluded that a new, unstable isotope had been produced in the laboratory—aluminium had been transmuted to phosphorus.

Irene worked on the nuclear bombardment of uranium with slow neutrons, and in 1938 she and P Savitch analysed the products and reported one very similar to lanthanium. She later almost anticipated nuclear fission but like many other physicists at that time found it too difficult to accept the simple hypothesis that heavy elements like uranium could split into lighter elements produced by the decay of uranium. The work helped Otto Hahn and F. Strassman to their startling discovery of nuclear fission.

In 1936 Irene Joliot-Curie was appointed Under-Secretary of State for Scientific Research. During 1946-51 she was one of the four scientific commissioners for the French atomic energy project.

Irene had inherited the expertise, single-mindedness, and scientific insight of her parents. Like her mother Irene produced a further generation of scientists. She died at the age of 59 of leukemia which was a result of prolonged exposure to intense radiation. Her daughter Helene, married the son of Marie Curie's old companion, Paul Langevin, and, together with her brother, Paul, became a distinguished physicist.

Note: The prize was awarded jointly to Frederic Joliot and Irene Joliot-Curie.

Physiology or Medicine

For his discovery of the organizer effect in embryonic development.

Spemann, Hans, b.—June 27, 1869, Stuttgart, Baden-Württemberg, d.—September 12, 1941, Freiburg-im-Breisgau, Germany. Spemann had his primary education in a *Gymnasium.* After leaving school he joined his father's business and then served in the army before commencing his studies at the universities of Heidelberg, Munich and Würzburg. He was the student of famous teachers like the anatomist Carl Gegenbauer and Roentgen, the first Nobel Laureate in Physics. He graduated in 1895, and became Lecturer in Zoology in 1898. In 1909, he was called to the Chair of Zoology at Rostock. He became the Director of the Kaiser Wilhelm Institute for Biology at Berlin-Dahlem. He was called to the Chair of Zoology in the University of Freiburg-im-Breisgau in 1919 and remained there till his retirement in 1935.

Spemann developed a new branch of science called developmental physiology while he was Professor of Zoology at Rostock. Wilhelm Roux and Hans Driesch had independently showed that, if after the first cleavage of the egg of an amphibian one of the two resulting cells is removed, the remaining cell grows into a smaller but complete embryo. Instead, if one of the two cells is destroyed but not removed the remaining cell develops into half an embryo. Spemann was particularly interested in germ development. Much earlier in his life, while he worked as an apprentice to a bookseller at Würzburg, he learnt that microscopic technique and micro-instrumental possibilities may be utilized for the study of germ development. By means of his very skilled technique of micro-dissection, Spemann now began to study whether the fate of individual cells in a very young embryo was pre-determined from the beginning.

SPEMANN, HANS
Germany

Spemann transplanted a definite area from one embryo into a definite area of another, and he used eggs of different species which differed in colour, so that the transplanted areas remained distinguishable as they developed. He made use of vital stains at times. His experiments showed that a portion of tissue normally destined to form epidermis could develop into nervous tissue if it was transplanted to the area where the spinal cord normally develops. The transplantation of part of the anterior end of the embryonic blastopore which was originally destined to develop into the nervous system, into the neutral aspect of another embryo developed into a new central nervous system which did not develop from the transplanted but from the ventral cells originally destined to produce epidermis. Hence the fate of the ventral cells had been changed by the presence of the transplanted blastopore tissue. Spemann concluded that the blastopore tissue had an "organising effect" on its environment.

Peace

Von Ossietzky, Carl, b.—October 3, 1889, Hamburg, d.—May 4, 1938, Berlin. Ossietzky had always been an ardent pacifist, and on one occasion had incurred a court sentence for an attack on Prussian militarism. He was further confirmed in his pacifist convictions by his experience as a frontline soldier in the German army during World War I. Immediately after the war, he worked actively for peace movement. In 1920, he was appointed secretary of the *Deutsche Friedensgesellschaft* (German Society for Peace) by Ludwig Quidde. However, Ossietzky felt that his particular bent was not in the organizational sphere. It was as a writer that he was to make his mark.

VON OSSIETZKY, CARL
Germany

In 1921, he became foreign editor of the *Volkszeitung,* in which capacity he became an ardent spokesman for the policy of conciliation. In 1924, he became joint editor of the radical periodical *Die Weltbuehne,* and editor-in-chief in 1927. In the same year he published an article by Berthold Jacob, which attacked the authorities for shielding a number of military chiefs. Jacob and Ossietzky were sentenced, first to short periods of imprisonment, later to fines, which were, however, remitted under the terms of an act of amnesty.

The next time Ossietzky came into conflict with the authorities was in connection with his campaign against secret German rearmament. In the *Weltbuehne* of March 12, 1929, he published an article written by an aircraft technician, who accused the German Ministry of Transport of working in contravention to the Constitution. Ossietzky himself was strongly in favour of a revision of the peace treaty. He thought that secret German rearmament would only strengthen the aggressive forces in Germany and other countries and bring fresh disasters to the people of Europe. Both the aircraft technician and Ossietzky were prosecuted on a charge, based on an Espionage Act of 1914, of disclosing military secrets. They were found guilty and sentenced to eighteen months of imprisonment. The sentence aroused tremendous uproar in Liberal circles, and several protest meetings were held. Ossietzky's friends advised him to flee the country but he preferred to go to prison so that he could continue to fight for his ideas in his native land. After seven months of imprisonment he was released under the terms of an act of amnesty on December 2, 1932. He immediately resumed his work on *Die Weltbuehne* and from then on he concentrated on the struggle against the rising tide of Nazism. Ossietzky had never underestimated Hitler and his movement, nor was he misled by the temporary setback which the Nazis suffered during the 1932 elections. He realized the strong appeal which the movement had for the German middle classes, who were basically anti-semitic.

On February 3, 1933, Ossietzky was due to deliver a lecture on "Cultural Barbarism" at the invitation of the German League for Human Rights. The Berlin Police authorities, however, banned the lecture, on the ground that people of different views might take offence. The lecture was delivered instead on February 26 before a closed meeting of German authors, in which he discussed the possibilities of a united front against Nazism. On February 27, the Reichstag fire took place; the same night Ossietzky was arrested and shortly afterwards taken to the Sonnenburg concentration camp, and later to Papenburg Esterwegen. It is not difficult to imagine what physical and mental torture he had to undergo in these horrible concentration camps.

1936

PHYSICS

Anderson, Carl David / Hess, Victor Franz

CHEMISTRY

Debye, Petrus (Peter) Josephus Wilhelmus

PHYSIOLOGY OR MEDICINE

Dale, Sir Henry Hallett / Loewi, Otto

LITERATURE

O'Neill, Eugene Gladstone

PEACE

Saavedra Lamas, Carlos

1936

Physics

For his discovery of the positron.

Anderson, Carl David, b.—September 3, 1905, New York City. Born of Swedish parents Carl David Anderson and Emma Adolfina Ajaxson, he graduated from and later received his Ph.D. *magna cum laude* in 1930 from the California Institute of Technology, where he worked with Millikan on cosmic rays and became professor of physics in 1939 and chairman of the division of physics, mathematics, and astronomy in 1962. Having studied X-ray photoelectrons since 1927, he began research in 1930 on gamma-rays and cosmic rays, utilizing the magnetic cloud chamber. In 1932, Anderson discovered the "positron" in the course of cosmic-ray interaction studies and one year later succeeded in producing positrons by gamma irradiation. In 1936, he participated in the discovery of the "muon", an elementary particle about 207 times as massive as the electron. The positron and meson are short-lived particles. The positron reacts with an electron and produces an equivalent amount of energy in the form of a pair of gamma rays following Einstein's famous equation $E=mc^2$. The positively charged meson could be broken down to positrons and neutrinos, while a negatively charged meson breaks down to electrons and neutrinos. He shared the prize with the Austrian Physicist V.F. Hess for his discovery of the positron, or anti-electron, the first known particle of antimatter.

ANDERSON, CARL DAVID
USA

He married Lorraine Bergman in 1946; they have two sons Marshall and David. ◇

For his discovery of cosmic radiation.

Hess, Victor Franz, b.—June 24, 1883, Waldstein, Austria, d.—December 17, 1964, Mount Vernon, New York State. Son of Vinzens Hess and Serafine Edle von Grossbauer-Waldstatt, he received his entire education in Graz, taking his Ph.D. in 1910.

A physicist who jointly received the prize along with C.D. Anderson of the USA, he discovered cosmic rays. He was on the faculty of the Vienna Academy of Sciences for a number of years and was professor at the University of Graz in 1920 from where he went to the United States to pursue his cosmic ray research. In 1938 he joined the Fordham University and worked there till his retirement in 1956. His research principally dealt with radioactivity and atmospheric electricity. Before 1911, he studied the electrical conductivity of the atmosphere during ascents in balloon and on high mountains. He observed that the electrical conductivity increased rapidly with the altitude. He found that an extremely penetrating extraterrestrial radiation penetrated the earth's atmosphere. He was deeply interested in locating the source of the background radiation that was responsible for the ionizations in the atmosphere. Hess found from his high altitude balloon experi-

HESS, VICTOR FRANZ
Austria

ments, that radiations are up to eight times greater than that observed at the surface of the earth. He suggested that these high energy radiations came from outer space. Millikan named these radiations as "Cosmic rays". Further enquiry into the above radiation led to the discovery of the positron by Anderson and opened up new avenues of research in modern physics. After World War II, he was engaged in the studies of radioactive fallout from nuclear bombs. He strongly opposed nuclear tests.

Note: The prize was awarded jointly to Anderson and Hess.

Chemistry

For his contributions to our knowledge of molecular structure through his investigations on dipole moments and on the diffraction of X-rays and electrons in gases.

Debye, Petrus (Peter) Josephus Wilhelmus b.—March 24, 1884, Maastricht, Netherlands, d.—November 2, 1966, Ithaca, New York. Deby studied in the local elementary and secondary schools in Maastricht, and later joined the Aachen Institute of Technology from where he obtained a degree in electrical technology in 1905.

He worked for two years as Assistant in Technical Mechanics at the Institute. He took up a similar appointment in Theoretical Physics at Munich University in 1906, from where he obtained his Ph.D. in Physics in 1908, and in 1910 qualified as a lecturer. During 1911-12, he was Professor of Theoretical Physics at Zürich University. In 1912, he became Professor of Theoretical Physics at Utrecht University, Netherlands, and in 1919 took charge of the Theoretical Department of the Physical Institute, University of Göttingen, where he became Director of the entire Institute and lectured on experimental physics until 1920. Debye was appointed Professor of Physics, and Principal of Eidgenossische Technische Hochschule, Zürich, in 1920, and in 1927 held the same post at Leipzig. He was Director of the Max Planck Institute for Physics in Berlin-Dahlem and Professor of Physics, University of Berlin, during 1934-39.

Two months before the German invasion of the Netherlands, Debye went to Ithaca, New York to deliver a lecture at the Cornell University and remained there until his retirement as Chairman of the Department of Chemistry in 1952. He was appointed Emeritus Professor of Chemistry at Cornell University in 1946, he later took American citizenship.

Debye was married to Mathilde Alberor; they had a son and a daughter.

The first important research of Debye, dipole moment studies, advanced the knowledge of arrangement of atoms in molecules and of the distance between the atoms. He showed that solid substances could be used in powdered form for X-ray study of their crystal structures, thus bypassing the difficult step of first preparing good crystals.

DEBYE, PETRUS (PETER)
JOSEPHUS WILHELMUS
The Netherlands

During the course of the development of the X-ray crystallographic methods of investigation, he soon found that even the relatively simple arrangement pattern, resulting from the fact that the molecules of a gas have the same structure, can suffice to produce a detectable interference effect when X-rays penetrate a gas; the diffracted rays have an intensity which changes regularly with the angle of diffraction.

Physiology or Medicine

For their discoveries relating to chemical transmission of nerve impulses.

Dale, Sir Henry Hallett, b.—June 9, 1875, London, d.—July 23, 1968, Cambridge. A physiologist who isolated acetylcholine in 1914, Dale along with the Austrian pharmacologist Otto Loewi received the prize for their discoveries in the chemical transmission of nerve impulses.

DALE, Sir HENRY HALLETT
Great Britain

Dale graduated in medicine from Cambridge. He began his research career in 1904 at the Wellcome Physiological Research Laboratories. His work on the chemical composition and effects of ergot of rye led to his identification of histamine or a histamine like substance which was claimed to be responsible for some allergic and anaphylactic reactions. He was the director of National Institute for Medical Research. He was also president of the Royal Society and Chairman of the Scientific Advisory Committee on Atomic Energy. He was knighted in 1932 and awarded the Order of Merit in 1944.

◆

For their discoveries relating to chemical transmission of nerve impulses.

Loewi, Otto, b.—June 3, 1873, Frankfurt-am-Main; d.—December 25, 1961, New York City. A physician and pharmacologist who with Sir Henry Dale received the prize for the discoveries relating to the chemical transmission of nerve impulses. Loewi graduated in medicine from the University of Strassburg, he then studied and taught in several European universities, becoming professor of pharmacology at Graz, Austria.

LOEWI, OTTO
Austria

In 1940, he went to the United States of America where he was made a research professor at the New York University School of Medicine. His neurological researches provided the first proof that chemicals elaborated by the nerves were involved in the transmission of impulses from one nerve cell to another and from a neuron to the active organ. He and his colleagues slowed the heart rate of a frog, by stimulating the vagus nerve of the heart. The fluid perfusing this heart was allowed to perfuse a second heart in which the nerve were not stimulated; but the second heart also slowed in rate, indicating the presence of an invisible reactive substance in the fluid. This substance was shown to be *acetylcholine,* which had been isolated from animal tissue by Dale and Harold Dudley in 1929.

In addition to researches on the nervous system, he studied diabetes and the action of digitalis and adrenaline. He devised the "Loewi's test" for detection of acute haemorrhagic pancreatitis.

Note: The prize was awarded jointly to Dale and Loewi.

Literature

For the power, honesty and deep-felt emotions of his dramatic works, which embody an original concept of tragedy.

O'Neill, Eugene Gladstone, b.—October 16, 1888, New York City, d.—November 27, 1953, Boston. He was the first US dramatist to regard the stage as a literary medium and presented serious themes to the American audience through theatre. He was the son of an actor and passed through an insecure childhood. He studied at the Princeton University for one year (1906-07) and spent six years as a seaman, living the life of a derelict on some of the notorious waterfronts of the world.

O'NEILL, EUGENE GLADSTONE
USA

He contacted phthisis and was confined to a sanatorium (1912-13). He was greatly influenced by Nietzsche and Strindberg and began to write plays while convalescing in the sanatorium. His first play was a one-act sea play, *Bound East for Cardiff* (1916), which was followed by a full-length play, *Beyond the Horizon* (1920) which was awarded a Pulitzer Prize. Other prize-winning plays were *Anna Christie* (1922), *Strange Interlude* (1928), and *Long Day's Journey into Night* (posthumously published in 1956).

He was one of the most important playwright on the Broadway during the twenties and thirties which saw plays like *The Emperor Jones* (1920), *Desire under the Elms* (1924), *The Hairy Ape* (1922), *Mourning Becomes Electra* (1931) which won him the prize when he became the first US playwright to be honoured with the prize for literature. It is still considered that his work *The Iceman Cometh* (1946) is the best. His daughter Oona O'Neill married one of the greatest of all thespians of the 20th century, Charles Chaplin.

Peace

Saavedra Lamas, Carlos, b.—1878, d.—1959. The Argentinian Foreign Minister, Carlos Saavedra Lamas, received the prize in 1936. Lamas' work in the international sphere first bore fruit with the drafting of an anti-war pact, which was signed in Rio de Janeiro in October 1933, by representatives of Argentina, Brazil, Mexico, Chile, Uruguay and Paraguay. In June 1934, the signatories of the pact increased by as many as fourteen Spanish American states, Brazil, the USA and Italy. The treaty was envisaged as a universal agreement, similar to the Kellogg Pact, and Argentinian diplomats worked with great vigour to induce the countries of Europe to join the pact. Another feature of the pact was that it also guaranteed international co-operation for the re-establishment of peace, while at the same time maintaining the principle of neutrality.

SAAVEDRA LAMAS, CARLOS
Argentina

1937

PHYSICS

Davisson, Clinton Joseph
Thomson, Sir George Paget

CHEMISTRY

Haworth, Sir Walter Norman / Karrer, Paul

PHYSIOLOGY OR MEDICINE

Szent-Györgyi von Nagyrapolt, Albert

LITERATURE

Du Gard, Roger Martin

PEACE

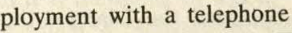
Cecil of Chelwood,
Lord Edgar Algernon Robert Gascoyne Cecil

1937

Physics

For their experimental discovery of the diffraction of electrons by crystals.

Davisson, Clinton Joseph, b.—October 22, 1881, Bloomington, Illinois, d.—February 1, 1958, Charlottesville, Virginia. He was the son of Joseph Davisson, an artisan, and Mary Calvery, a school teacher. After graduation from Bloomington Public School in 1902, he joined the University of Chicago on a scholarship. Unable to continue studies due to financial reasons, he found employment with a telephone company. He shared the prize with George P. Thomson of England for discovering that electrons can be diffracted like light waves, thus verifying the thesis of de Broglie of France that electrons behave like waves as well as particles.



DAVISSON, CLINTON JOSEPH
USA

Davisson received his Ph.D. in 1911 from Princeton University where he worked under Richardson on thermionic emission in heated materials. He joined the Carnegie Institute of Technology of Pittsburgh and worked there from 1911 to 1917. Later he joined the Bell Telephone Laboratories where he spent most of his career. He began his research there on thermionic emission and later helped to develop the electron microscope in 1927. He along with Gerner, of the Bell Laboratories, found that a beam of electrons, when reflected from a metallic crystal, shows diffraction patterns similar to those of X-rays and other electro-magnetic waves. The diffraction is caused by the atoms that are in an orderly array in the crystal structure and occurs just as predicted in de Broglie's theory. This discovery led to a greater understanding of the dual nature of subatomic particles and proved to be useful in the study of nuclear, atomic and molecular structure. In 1911 he married Charlotte Sara Richardson; they had three sons and one daughter.

◆

For their experimental discovery of the diffraction of electrons by crystals.

Thomson, Sir George Paget, b.—May 3, 1892, Cambridge, England, d.—September 10, 1975, Cambridge. A physicist and joint recipient with Clinton J. Davisson of the USA of the prize for demonstrating that electrons exhibit diffraction, a wave like property that is widely exploited in determining the atomic structure of solids and liquids. He was the only son of the Nobel Laureate (1906) Sir J.J. Thomson and Rose Elisabeth Paget, and worked in the Cavendish Laboratory at Cambridge University after World War I. In 1922, he was appointed professor of natural philosophy at the University of Aberdeen, Scotland, where he conducted experiments demonstrating that a beam of electrons is diffracted upon passage through a crystalline substance thus confirming a prediction made by the French physicist Louis de Broglie (1929 Nobel Laureate). In 1930, he became professor of physics at the Imperial College of Science and Technology in London; there he concentrated on the neutron and nuclear fusion. He was knighted in 1943, and nine years later became master of Corpus Christi College, Cambridge, from where he retired in 1962. His works include *Theory and Practice of Electron Diffraction* (1939) and *J.J. Thomson and the Cavendish Laboratory in His Day* (1965).

THOMSON, Sir GEORGE PAGET
Great Britain

Thomson married Kathleen Buchanan in 1924; they had two sons and two daughters.

Note: The prize was awarded jointly to Davisson and Thomson.

Chemistry

For his investigations on carbohydrates and vitamin C.

Haworth, Sir Walter Norman, b.—March 19, 1883, Chorlay, Lancashire, d.—March 19, 1950, Birmingham. He attended the local school and at the age of fourteen joined his father to learn linoleum design and manufacture. The use of dyes in his work aroused his interest in chemistry, and thus he started private tuition in Preston, which enabled him to pass the entrance examination of the University of Manchester. He graduated with first class honours in 1906 and went on a scholarship to Gottingen after three years of research. He received his doctor's degree in 1910 and returned to Manchester to be awarded his D.Sc. degree in 1911.

HAWORTH, Sir WALTER NORMAN
Great Britain

Haworth became a demonstrator at the Imperial College, London, in 1911, and was appointed Lecturer and Reader in Chemistry at St. Andrews, Scotland, in 1912. He became Professor of Chemistry at the University of Durham in 1920 and was appointed the Director the following year. In 1925 Haworth was appointed Professor and Director of the Department of Chemistry in the University of Birmingham, which he retained until his retirement in 1948. He became Dean of the Faculty of Science and acting Vice-Principal during 1947-48. After retirement he served on many Boards and Committees.

Haworth worked on the different forms of grape-sugar and on the arrangement of the atoms in cane-sugar, maltose and milk sugar, starch and cellulose. He extended Emil Fischer's method of reacting sugars with methanol to an elegant preparation of methylated derivatives which were, in turn, used to characterize the constitution of sugars. The model of glucose which he introduced in 1925 is represented in skeleton form as being built up of a ring of six atoms, five of these being carbon and one oxygen, together with an additional side-chain carbon atom. This he described as the pyranose four. Other normal hexoses have been shown to conform similarly to this same structural plan. Much less stable forms of pentose and hexose are those which he described as the furanose forms. It is in this form that certain sugars occur in a state of combination in Nature. On isolation, they revert to the normal or pyranose forms which have six atom rings.

These simple sugars acquire wider significance when regarded as the building stones in such complex natural products as cellulose and starch among others. Much of his work has been devoted to an inquiry into the manner in which two or more sugars unite with one another or are found united in Nature in the dissaccharides such as sucrose, maltose and others. By 1928, he had established the structures of maltose, cellobiose, lactose, gentiobiose, melibiose, gentianose, raffinose and the glucoside ring structure of normal sugars.

The basic difference between maltose (building stones of starch) and cellobiose (building stones of cellulose) lie in the linkage pattern between two glucose molecules. This difference is fundamental and also provides the reason for the difference in identity of starch and cellulose. Haworth found that starch is based entirely on the maltose model in as much as maltose is obtained in high yield from starch. On the other hand, cellobiose is the representative dissaccharide derived from cellulose and it is the mode of linking obtained in cellobiose which is repeated throughout the whole molecule of cellulose. Thus he concluded that more than two sugar molecules are assembled in various forms of carbohydrates.

In 1928 Szent-Györgyi (Nobel Laureate) isolated from the adrenal cortex and also from orange juice and cabbage, a highly reducing substance which has many of the properties of a carbohydrate. This substance was named hexuronic acid in virtue of its acidity and strong resemblance to highly reactive sugar acids. The molecular formula was established as $C_6H_8O_6$. It was renamed ascorbic acid on the suggestion of Haworth and Szent-Györgyi. Through a series of experiments investigating the potency of samples prepared from different sources and the observation that synthetic ascorbic acid prepared from completely inactive materials had the same degree of physiological activity as the natural substance, furnished final and incontrovertible proof that ascorbic acid was identical with vitamin C. Haworth's later researches contribute greatly towards further coordination of the chemical, physical and biological problems concerned with bacterial polysaccharides.

Haworth was awarded the prize jointly with Paul Karrer. Haworth was President of the Chemical Society (1944-46), became Fellow of the Royal Society in 1928, and during 1947-48 he was its Vice-President. He received honorary degrees from the universities of Belfast, Zürich and Oslo, honorary Doctor of Law from the University of Manchester, and foreign memberships of nine scientific academies. He won the Longstaff Medal, Chemical Society, in 1933, Davy Medal, Royal Society in 1934, and Royal Medal in 1942.

Haworth has a number of scientific papers to his credit, published in *Advances in Carbohydrate Chemistry*. He wrote a book *The Constitution of Sugars*, which was published in 1929.

He was married in 1922 and had two sons. ◆

For his investigations on carotenoids, flavins and vitamins A and B.

Karrer, Paul, b.—April 21, 1889, Moscow, d.—June 18, 1971, Zürich. Karrer was of Swiss origin and his father was a qualified dentist. The family went back to Switzerland when Karrer was three, to live in a small rural community. He did his schooling in Wildegg, Lensburg and Aarau, and in 1908 joined Zürich University to work under Alfred Werner (Nobel Laureate). Three years later he was awarded his D.Phil. degree for a thesis on nitrosopentaminocobalt salts. A year later he went to the Institute of Experimental Therapy in Frankfurt to work with Paul Ehrlich (Nobel Laureate) on organic compounds of arsenic. In 1918 he returned to Zurich as Professor of Chemistry and a year later succeeded Werner as Director of the Chemical Institute, a post he held until his retirement.

Karrer's main field of study was the chemistry of sugars and polysaccharides, by enzymatic splitting of the macromolecules to elucidate their structure. His work on the amination of cellulose fibres helped in the better understanding of the dyeing processes.

Karrer did pioneering work on the hydrocarbon plant pigment, particularly carotene and lycopene, which contain conjugated systems of double bonds, and also the closely related oxygen containing xanthophylls. By degradation and synthesis of the perhydro derivatives, Karrer had established by 1930 the structures of alpha and beta carotene and lycopene. He showed that the carotenoid pigments are basically constructed from eight isoprene units arranged end-to-end with a reversal at the centre of the chain.

KARRER, PAUL
Switzerland

In 1931 Karrer showed the structure of Vitamin $A_1(C_{20}H_{29}OH)$ to be an oxidation product of one half of the carotene molecule. He explained the structures of other vitamins like Vitamin B_2 (riboflavin) (1935), Vitamin B_{12}, Vitamin E (tocopherol) (1938) and confirmed the same by synthesis. He also studied curare alkaloids and alkoloids of equisetaceae. Karrer freely used the organic chemical techniques of his day but made particular use of bromine succinimide for bromination and lithium aluminium hydride as a reducing agent.

Karrer also investigated the chemical nature of co-enzymes, the relatively simple organic substances that are necessary for the proper functioning of the large, highly complex, enzyme molecules.

Karrer's book *Lehrbuch der organischen chemie,* on organic chemistry became a standard reference work and had considerable influence on the training of generations of organic chemists. The first edition of this book appeared in 1927, the demands were such that it ran through no less than twelve editions. The original German version of the book was translated into English, French, Spanish, Italian and Japanese. In 1948 he published his *Monographie über Carotinoide.*

Note: The prize was awarded jointly to Haworth and Karrer.

Physiology or Medicine

For his discoveries in connection with the biological combustion processes, with special reference to Vitamin C and the catalysis of fumaric acid.

Szent-Györgyi von Nagyrapolt, Albert, b.—September 16, 1893, Budapest. Szent-Györgyi was educated at the universities of Budapest and Cambridge. He was appointed Professor of Medical Chemistry in Szeged University, Hungary, where he worked during 1931-45. In 1947, he became Professor of Biochemistry, University of Budapest. He was appointed Director of the Institute for Muscle Research, Woods Hole, Massachusetts, in 1947. Later in 1975 he was appointed Scientific Director of National Foundation for Cancer Research, Massachusetts.

SZENT-GYÖRGYI NAGYRAPOLT, ALBERT
Hungary

Working at Cambridge University and at Rochester, Minnesota, he found and isolated an organic reducing agent, which he called hexuronic acid (now known as ascorbic acid) from plant juice and adrenal gland extracts. Later as Professor of Medical Chemistry at the University of Szeged, he helped to prove that the acid is identical to the anti-scurvy vitamin-C, discovered in 1907 by the German physician Axel Holst and the Austrian pharmacologist Alfred Trochlich.

Realizing that ascorbic acid is only one of many hydrogen transfer agents involved in cellular respiration, Szent-Györgyi turned to the study of organic compounds known to play a part in the conversion of carbohydrate breakdown products to carbon dioxide, water, and other substances necessary for the production of usable energy by the cell. In 1935, he found that the four-carbon fumaric acid is one such intermediate compound, that it is formed from the four-carbon succinic acid, and that it is in turn converted into the six-carbon citric acid. This discovery led the former German-British biochemist Sir Hans Krebs to elucidate the complete conversion cycle, now popularly known as "Krebs Cycle". Two years later, in 1936, Szent-Györgyi postulated the existence of vitamin P, which is necessary for the maintenance of capillary structure.

Devoting himself to the study of the bio-chemistry of muscular action, he discovered a protein in muscle that he named "action" (pronounced—aktion) and demonstrated that "action" in combination with the muscle protein myosin is responsible for muscular contraction. He showed that the compound adenosine triphosphate (ATP) is the immediate source of energy necessary for contraction. Emigrating to the USA in 1947 where he was appointed director of the Institute for Muscle Research, Massachusetts, he had conducted research into the causes of cell division and cancer.

Szent-Gyorgyi's work fetched him many honours from all over the world. For his discovery concerning the roles played by certain organic compounds like vitamin C in the oxidation of nutrients by the cell, he was awarded the prize in 1937. He won the Cameron Prize in 1946, and the Lasker Award in 1954. He was Honorary Fellow, Fitzwilliam College, Cambridge (1967) and awarded Honorary Science Degree, Cambridge (1963).

Szent-Györgyi was a vociferous opponent of US military policy in Vietnam, he expressed his strong views in his book *The Crazy Ape* (1970). His other publications include *Oxidation, Fermentation, Vitamins, Health and Disease* (1939), *Muscular Contraction* (1947, 1951, 1953), *The Nature of Life* (1947), *Submolecular Biology* (1960), *What Next?* (1976), *The Living State and Cancer* (1978).

Szent-Györgyi's interests are sports and music.

Literature

For the artistic power and truth with which he has depicted human conflict as well as some fundamental aspects of contemporary life in his novel-cycle 'Les Thibault'.

Du Gard, Roger Martin, b.—March 23, 1881, Neuilly-sur-Seine, France, d.—August 22, 1958, Le Tertre. A French novelist and dramatist who made a comprehensive survey of the French society of his time. He was born in a middle class family and studied at the Ecole des Chartes, Paris, and qualified as a photographer and archivist in 1905.

DU GARD, ROGER MARTIN
France

He served in a motor-transport unit during World War I. For a short period before and after the war he worked with Jacques Copeau at the Theatre du Vieux-Colombier. Most of his later life was spent in seclusion while he was busy writing. His first novel was *Devenir!* (1908), followed by *L'une de nous* (One of us, 1909) which was only a chapter of his abandoned novel *Mariose. Jean Barois* (1913, English, 1950) discussed the conflict between his early Catholic faith and his newly achieved intellectualism as well as his interpretation of the effects of Dreyfus affair on the French society. *Les Thibault* (1922-40, English, *The World of the Thibaults,* 1939-41) was a long novel in eight parts describing the story of two middle class brothers. The outstanding feature of this novel is the patient exploration of human relations. In *L'Ete* (1914) he dramatically described the European involvement in World War I. It has some similarity to *War and Peace* of Leo Tolstoy.

He wrote two farces about the French peasants, *Le Testament du Pere Leleu* (1913) and *La Gonfle* (1928). He wrote on homosexuality through his drama *Un Taciturne* (1931). His other works include *Confidents africaine* (1931), *Vieille France* (1933, English, The Postman, 1954) and *Notes Sur Andre Gide* (1951, English, 1953). In 1941, he started work on his masterpiece *Les Souvenirs du Colonel Maumort,* which remained unfinished till his death in 1958. His complete works entitled *Oeuvres completes de Roger Martin du Gard* was prefaced by Albert Camus and published in 1955.

Peace

Cecil of Chelwood, Lord Edgar Algernon Robert Gascoyne Cecil, 1st Viscount, called Lord Robert Cecil, b.—September 14, 1864, London, d.—November 24, 1958, Tunbridge Wells, Kent. A statesman, he was one of the principal draftsmen of the League of Nations Covenant in 1919 and one of the most loyal workers for the League until its supersession by the United Nations in 1945.

He was the third son of the 3rd Marquess of Salisbury, who was three times British Prime Minister. Lord Robert was successively under secretary of state for foreign affairs during World War I. As early as in 1916 he began to draw up an international peace-keeping agreement, and in 1919, he was sent to the peace conference in Paris, where his ideas proved generally compatible with those of the American President Woodrow Wilson and the South African Field Marshal, Jan Christiaan Smuts, the other two prominent advocates of the League of Nations. Like Smuts, Lord Robert believed in a world order determined by the white nations; he successfully opposed a provision for absolute racial equality among League member states.

CECIL OF CHELWOOD Viscount, (Lord EDGAR ALGERNON ROBERT GASCOYNE CECIL)
Great Britain

As the principal British delegate to the disarmament conference at Geneva, he disagreed with the instructions given to him and resigned from Prime Minister Stanley Baldwin's government. During the 1930s he unsuccessfully argued for League measures against aggression by Japan in Manchuria and by Italy in Ethiopia. He was one of the few in Parliament to vote against concession made to Nazi Germany at Munich in 1938 by Neville Chamberlain.

1938

PHYSICS
Fermi, Enrico

CHEMISTRY
Kuhn, Richard

PHYSIOLOGY OR MEDICINE
Heymans, Corneille Jean Francois

LITERATURE
Buck, Pearl

PEACE
Office International Nansen Pour Les Réfugiés
(Nansen International Office for Refugees)

1938

Physics

For his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons.

Fermi, Enrico, b.—September 29, 1901, Rome, d.—November 28, 1954, Chicago. He studied physics at the University of Pisa and received his doctorate in 1922. He worked with Max Born at Göttingen and P. Ehrenfest at Leiden. He was lecturer in mathematical physics at Florence between 1924 and 1926 and, in 1927, became professor of theoretical physics at Rome University. In 1929, he became Founder Member of the Royal Academy of Italy, he was also a Foreign Member of the Royal Society.

The discovery of radioactivity by Frederic Joliot and Irene Joliot-Curie interested Fermi who at that time was working on quantum statistics and on ß-decay and the neutrino. Within a few months of his taking up the new problem Fermi could show that radioactive isotopes of most elements could be produced by neutron bombardment. The intensity of the radioactivity thus induced, however, depended on the surroundings of the specimen undergoing bombardment. This was due to the slowing down of the neutrons in passing through the surroundings, i.e., a jacket of water or paraffin produced a much greater intensity. This work was to form the basis of the atomic pile, for it showed how the speed of nuclear reaction could be controlled. Fission is the breaking up of single atoms of an element into two new atoms of a different element and is accompanied by the release of neutrons, and energy in the form of heat and light. These neutrons could themselves cause other atoms to undergo fission, thus creating a self-sustaining chain reaction which could provide, theoretically, a constant flow of fission energy.

In 1938, when his work in neutron physics was acknowledged by the award of the Nobel Prize, Mussolini expected him to attend the Nobel ceremony in Stockholm in Fascist uniform but Fermi, who loathed fascism, refused. Already unpopular among the Italian fascists for his Jewish wife, his refusal only increased the vicious attacks on him by the Italian Press; Fermi, with his wife, went to the United States from the Nobel Ceremony in Stockholm and settled there permanently. At the Columbia University he began building a small "pile" which he completed in 1941, but was not large enough to be "divergent" . At the end of 1941 his group migrated to the University of Chicago where they set about building a larger, self-sustaining pile. Around this time several scientists including Fermi and Albert Einstein, who had realized that the fission process could be used to build a devastating weapon and the implications of such a weapon being developed by Hitler's scientists, wrote to Franklin D. Roosevelt. The response from the US Govern-

FERMI, ENRICO
Italy

ment was immediate. Fermi was appointed head of the research team to design a nuclear reactor. On December 2, 1942 on one of the squash courts of the Chicago University, the world's first self-sustaining nuclear chain reactor became operational. News of his success was cabled to the government as "The Italian navigator has entered the New World" by a prearranged code.

In 1943, Fermi went to Los Alamos, New Mexico, where the Manhattan atomic bomb project was established, and worked there until the end of the war. He returned to academic life and continued his research on radioactivity. Among his notable personal characteristics were his great joy of living and his charm.

The problem to overcome was that the nuclear chain reaction could become too rapid thus leading to overheating and cause an atomic explosion. Fermi's knowledge of neutron physics helped him design a means to keep the chain reaction under control. He used cadmium rods as 'neutron absorbers' which could be inserted or withdrawn from the reactor to keep the neutrons in check.

Fermi married Laura Capon in 1928; they had one son and one daughter.

Chemistry

For his work on carotenoids and vitamins.

Kuhn, Richard, b.—December 3, 1900, Vienna, d.—August 1, 1967, Heidelberg. His father was an engineer and his mother a teacher. He was educated in a grammar school, the "Gymnasium". From 1910 to 1918, Kuhn was a schoolmate of Wolfgang Pauli who was awarded the Nobel Prize in Physics for 1945. He studied chemistry at Vienna University, and obtained his doctorate on *On the Specificity of Enzymes*, in 1922 from Munich University; he was the student of Richard Willstätter (Nobel Laureate).

Kuhn was appointed Lecturer in Chemistry at Munich University in 1925. He held the post of Professor for General and Analytical Chemistry from 1926 until 1929 on invitation by the *Technische Hoschschule* in Zürich. He was appointed Principal of the Institute for Chemistry at the newly founded Kaiser Wilhelm Institute for Medical Research in Heidelberg in 1937. He was also Professor of Biochemistry at the University of Heidelberg and, for a year, was at the University of Pennsylvania, Philadelphia, as a Visiting Research Professor for Physiological Chemistry.

KUHN, RICHARD
Austria/Germany

Kuhn investigated theoretical problems of organic chemistry, and also studied biochemistry. He worked for twenty years on conjugated double bonds which make up the essential arrangement of the atoms of the polyenes. This study proved to be of great interest in connection with the study of chemical nature of carotenoids. Willstätter had established the elementary composition of carotene, $C_{14}H_{56}$. Kuhn in 1931 and Kaiser and Rosenheim had discovered simultaneously and independently that the carotene in carrots consists of two separate components alpha and beta-carotenes. A third isomer gamma-carotene was discovered by Kuhn in 1933. Carotene is hydrolysed in the liver of certain animals so that from one molecule of beta-carotene or from two molecules of alpha-carotene, two molecules of Vitamin A, Axerophtol, are formed. This substance is necessary for growth in higher animals and also for maintenance of the normal condition of the mucous membranes.

Kuhn discovered certain important carotenoids in certain plants and determined their structure. He also established the composition of Rodoxanthin and Astaxanthin, and discovered the connection of the latter with the chromoproteids of the crustaceans. He has also perfected the chromatographic method which is one of the most important aids to the isolation and synthesis of the different carotenoids.

Kuhn isolated Vitamin B_2 (Lactoflavin or Riboflavin). He liberated Lactoflavin from skim milk and found its composition to be $C_{17}H_{20}O_6N_4$. He successfully isolated Vitamin B_6, the antidermatitis Vitamin, and in a remarkably short time, he established its chemical composition and structure.

Kuhn was forbidden by the Nazis to accept the award; therefore, he received it after World War II. He was awarded honorary degrees of the Technische Hochschule in Munich (1960), University of Vienna (1960), University of St. Maria, Brazil (1961). He was presented numerous medals and prizes, as well as orders. He was the President of the Society of German Chemists, Vice-President of the Max Planck Society and Editor of *Liebigs Annalen der Chemie*.

Kuhn was married; he had two sons and four daughters.

Physiology or Medicine

For the discovery of the role played by the sinus and aortic mechanisms in the regulation of respiration.

Heymans, Corneille Jean Francois, b.—March 28, 1892, Ghent, Belgium, d.—July 18, 1968, Knokke. At the University of Ghent (1920-68), Heymans worked with his father whom he succeeded (1930) as professor of pharmacology. Experimenting with anesthetized dogs, he demonstrated the existence of a set of sensory organs, known as 'pressor receptors' in the wall of the carotid sinus which is an enlarged portion of the carotid artery near its bifurcation. He showed that these receptors monitor blood pressure and help to regulate heart rate and respiration. He also found near the pressor receptors, and at the base of the aorta, a set of *chemoreceptors* or *glomera*, which monitor the oxygen content of the blood and help to regulate breathing through the respiratory centre at the base of the brain.

HEYMANS, CORNEILLE JEAN FRANCOIS
Belgium

Literature

For her rich and truly epic descriptions of peasant life in China and for her biographical masterpieces.

Buck, Pearl, b.—June 26, 1892, Hillsboro, West Virginia, d.—March 6, 1973, Danby, Vermont. Noted for her novels on life in China, Pearl Buck spent her youth in China where her parents were Christian missionaries. She received her early education in Shanghai; she graduated from Randolph-Macon Woman's College, Lynchburg, Virginia, in 1914. She returned to China and became a teacher at the University of Nanking.

BUCK, PEARL
USA

Her articles and stories about Chinese life first appeared in American magazines during 1923, but she became famous only in 1931 with *The Good Earth*, which poignantly describes the struggle of a poor Chinese peasant and his slave-wife to gain a piece of land. The novel was awarded the Pulitzer Prize in 1932 and was widely translated. It was followed by *Sons* (1932), *Shui Hu Chuan* (All Men are Brothers, 1933), *The Mother* (1934) and *A House Divided* (1935). The trilogy was later published as *The House of Earth* (1935).

In 1934, after her divorce she married a New York publisher and thereafter lived in the USA. After World War II she founded the "Pearl S. Buck Foundation" to help the illegitimate children of the American soldiers in Asian countries.

Her last books include *The Patriot* (1939), *An American Legend* (1940), *Dragon Seed* (1942) *Imperial Woman* (1956) and *Satan Never Sleeps* (1962). She wrote her autobiography, *My Several Worlds*, in 1954. In 1951, she was elected to the American Academy of Arts and Letters and also became the President of the Authors Guild.

◆

Peace

OFFICE INTERNATIONAL NANSEN POUR LES REFUGIES (NANSEN INTERNATIONAL OFFICE FOR REFUGEES)

Geneva

The office had been set up by the League of Nations in 1930. The refugees, the office had to deal with, had lived in actual exile since the great political upheavals during and after World War I. The majority of them were Russians and Armenians. It was very difficult to rehabilitate the Armenian refugees but Nansen endeavoured to settle them till the last years of his life. Apart from actual rehabilitation the office had constantly to intervene on behalf of the refugees in various countries, and protect them from bureaucratic repression and neglect. After World War II the office issued 'Nansen Passport' to stateless refugees who were accepted as emigrants to countries outside the Axis and Fascist blocks.

1939

PHYSICS

Lawrence, Ernest Orlando

CHEMISTRY

Butenandt, Adolf Friedrich Johann
Ruzicka, Leopold

PHYSIOLOGY OR MEDICINE

Domagk, Gerhard

LITERATURE

Sillanpää, Frans Eemil

1939

Physics

For the invention and development of the cyclotron and for results obtained with it, especially with regard to artificial radioactive elements.

Lawrence, Ernest Orlando, b.—August 8, 1901, Canton, South Dakota, d.—August 27, 1958, Palo Alto, California. Lawrence was educated at the University of South Dakota, graduating in 1922. He obtained his Ph.D. from the Yale University in 1925. He was an assistant professor of physics at the Yale University (1927-28). He went to the University of California, as an associate professor and became full professor in 1930. He first conceived the idea for the cyclotron in 1929. The first model was constructed by one of his students in 1930 but was not successful. Another student undertook the project and succeeded in building one that accelerated hydrogen to an energy of 13,000 electron volts. Lawrence then set out to build a second cyclotron; it accelerated protons to 1,200,000 electron volts, the energy was enough to cause nuclear disintegration. To continue his work, he built the Radiation Laboratory at Berkeley and became its director in 1936. It was one of Lawrence's cyclotrons that produced *technetium*, the first artificial element that does not occur in nature. Technetium is now in constant use as the radio-isotope for the detection of brain tumours by scintigraphy. Lawrence's basic design was utilized in developing other particle acclerators and have been largely responsible for the great advances made in the field of particle physics. With the award of the prize, he was also honoured for his contributions to chemistry, biology and medicine, made possible by the new artificial elements manufactured in the acclerator. With the cyclotron he produced radioactive phosphorus and other isotopes also for medical use, including radioactive iodine for the first therapeutic treatment of the hyperfunction of thyroid gland. In addition, he instituted the use of neutron beams in treating cancer.

LAWRENCE, ERNEST ORLANDO
USA

During World War II he worked with the Manhattan Project as a program chief incharge of the development of the electromagnetic process of separating uranium-235 for the atom bomb. In 1957, he received the Fermi Award from the US Atomic Energy Commission. Besides his work in nuclear physics, Lawrence invented and patented a colour television picture tube.

He married in 1932 and had six children.

Chemistry

For his work on sex hormones.

Butenandt, Adolf Friedrich Johann, b.—March 24, 1903, Bremerhaven-Wesermunde, West Germany. Son of a businessman, Butenandt studied in a local school in Bremerhaven. He studied chemistry at the Universities of Marburg and Göttingen, from the latter he graduated in 1927; studied under Adolf Windaus (Nobel Laureate).

Butenandt was Scientific Assistant at the Institute of Chemistry, Göttingen (1927-30) and from 1931 until 1933 was Privatdozent in the Department of Biological Chemistry at the University of Göttingen and acting Head of the laboratories for organic and inorganic chemistry. He was appointed Professor Ordinarius and Director of the Institute for Organic Chemistry at the Institute of Technology at Danzig, a post which he held until 1936.

BUTENANDT, ADOLF FRIEDRICH JOHANN
Germany

Butenandt was Professor at the University of Berlin and Director of the Max Planck Institute for Biochemistry, Berlin-Dahlem, from 1936 until 1960. In 1945, he was appointed Professor of Physiological Chemistry at Tübingen, and became Professor of Physiological Chemistry at the University of Munich in 1956. He has been President of the Max Planck Society at Munich since 1960.

In 1929, Butenandt in Göttingen, simultaneously with Doisy in the US, succeeded in isolating *oestrone* from the urine of pregnant women. Butenandt named it folliculine, and established its empirical formula as $C_{18}H_{22}O_2$. When Marrian in London (1930) isolated *oestriol* from the urine of pregnant women, Butenandt confirmed the discovery and explained the relationship between oestriol and oestrone. Butenandt and Marrian showed that only three benzoide double bonds enter into the ring system of these substances. He proved that both these oestrogenic hormones contained a phenanthrene core. He confirmed that a close relationship existed between the follicle hormones on the one hand, and the bile acids and sterols on the other. In 1934, Butenandt and Westphal successfully produced a chemically pure form of progesterone from Corpus luteum. He also showed its close relationship with pregnanediol, a hormone which he and Marrian had found independently, in the urine of pregnant women. He successfully converted pregnanediol into progesterone. In 1939, he synthesized progesterone from cholesterol.

Through a process of purification, Buternandt, for the first time, obtained a crystalline substance with the physiological properties of a male sex hormone, which he named androsterone, and defined its composition as $C_{19}H_{30}O_2$. In 1935, Laqueur and his colleagues isolated a highly active hormone called testosterone from the extracts of testes. The same year Butenandt and Ruzicka, independent of each other, obtained testosterone from trans-dehydro-androsterone, when the close relationship between testosterone and androsterone was already established. Butenandt, Ruzicka and others produced from sterols male sex hormones, which were found to be active in varying degrees. Butenandt studied the carcinogenic effect of some sex hormones. He also found a new class of natural dyestuff like *ommochromes*.

Due to political conditions at the time, he was prevented from accepting the prize; he therefore received it after World War II. He was awarded several medals and prizes from Germany, France, Sweden and England. He received the Grand Cross for Federal Services with Star (1959), and holds honorary doctorates from Munich, Graz, Leeds, Madrid, and two from Tübingen. He is corresponding member of the Academy of Sciences at Göttingen, honorary life member of the New York Academy of Sciences, and honorary member of the Japanese Biochemical Society, the Deutsche Akademie der Naturforscher Leopoldina, Halle, and the Austrian Academy of Sciences.

Butenandt married in 1931, has seven children, and lives in Munich-Obermenzing.

◆

For his work on polymethylenes and higher terpenes.

Ruzicka, Leopold, b.—September 13, 1887, Vukovar, then Austria, Hungary. Ruzicka attended the primary school and classical gymnasium in Osijek, where the Croatian language was used. His main interests were physics and mathematics but he decided to study chemistry since he was interested in the composition of natural products.

In 1906, he began his studies in chemistry at the *Technische Hochschule* in Karlsruhe. He completed his laboratory courses in 21 months and then immediately started his doctoral work on ketones with Professor Staudinger. After two years of research work, Ruzicka was "Dipl. Ing", and two weeks later "Dr. Ing". He became Staudinger's assistant, and together they investigated pyrethrins, a plant product, toxic to insects and other cold blooded animals. He went to Zürich in 1912 to join the Federal Institute of Technology there; in 1917 he acquired Swiss citizenship. He was supported by Haarman and Reimer of Holzminden in Germany, the oldest perfume manufacturers in the world, for the accomplishment of his habilitation work, necessary to become a 'Privatdozent'. After his habilitation in 1918, the firm of Ciba, Basle, became interested in his work on the preparation of *quinine* like compounds. He was invited by Chuit, Naef and Firmenich, the Geneva Perfume manufacturers, to collaborate with them in 1921.

RUZICKA, LEOPOLD
Switzerland

In 1926 he became professor of organic chemistry at the University of Utrecht, but within three years he came back to his Institute in Switzerland. The main reason for this decision was the strength of the Swiss organic chemical industry, especially its pharmaceutical and perfumery branches, which required the skill and energy of a whole army of chemists with a thorough training in modern organic chemistry. The renewal of the contract with his laboratory by Ciba in 1930 led to important successes in the field of the male sex hormones. He was unconditionally financed by the Rockefeller Foundation for his research on natural compounds, especially the triterpenes and steroids.

The main subject of Ruzicka's investigations has been higher terpenoids of polyterpenes which are abundant in the vegetable kingdom. His exceptional work has helped in the determination of their structure, and has led to thorough investigations of a number of important polyterpenes.

Ruzicka discovered while working with musk and civet that the molecule of muscone and that of civetone contain one single ring of carbon atoms, the number of which being much larger than all the then known cyclic molecules. He synthesized many macrocylic compounds, and showed that these could be prepared from natural fatty acids.

There exists an interesting relationship between the polyterpenes studied by Ruzicka, and bile acids, sterols and the sex hormones which are physiologically and medicinally important groups of compounds. Ruzicka successfully prepared compounds with the same action as male sex hormones which has made possible the technical synthesis of these two hormones.

Ruzicka was awarded the prize jointly with Butenandt. He holds honorary doctorates in science, medicine, natural sciences and law. He is honorary member of numerous chemical, biochemical and other scientific societies, and honorary, ordinary and foreign member of many scientific academies.

Ruzicka's hobbies are gardening and painting. He married Anna Hausmann in 1922 and Gertrud Acklin in 1951. He has no children. He now lives in Zürich.

Note: The 1939 prize was divided equally between Butenandt and Ruzicka.

Physiology or Medicine

For the discovery of the anti-bacterial effects of prontosil.

Domagk, Gerhard, b.—October 30, 1895, Lagow, Brandenburg, now in Poland, d.—April 24, 1964, Burgberg, near Koenigsfeld, now in Germany.

At the age of 28, he qualified as a university lecturer in Griefswald with a dissertation entitled "Investigation of the significance of the reticulo-endothelial system for the destruction of infecting micro-organisms and in the formation of amyloid". Not being a pharmacologist or chemist, Domagk had not himself developed the sulphonamides, of which the first was prontosil, which had been known for twenty years already and could be produced in the laboratory. Prontosil was submitted to him for testing by his colleagues Mietysch and Klarer. After meticulous research Domagk was convinced that a mouse infected with streptococcus survived after receiving prontosil.

DOMAGK, GERHARD
Germany

Providentially, Domagk decided to test prontosil on his four year old daughter, who had developed phlegmon on her arm, the result of a pin prick. The doctors, after making 14 incisions, had recommended amputation. He prescribed the medication for his daughter, and the arm healed and the child was saved. Domagk never published the first successful test on human being and we know of it only from accounts given by friends.

After teaching at the Universities of Greifswald and Muenster, Domagk became director of the I.G. Farbenindustrie's research laboratory for Experimental Pathology and Bacteriology. There, in a systematic survey for new drugs, he noticed the antibacterial action of one of the dyes against streptococcal infection in mice. The dye, Prontosil rubrum, was then tried clinically. He was also active in research on tuberculosis and cancer.

Unable to accept the prize because of Hitler's stricture at the time of announcement, he received it in 1947. The accompanying monetary award had, however, in accordance with the statutes, been forfeited.

Literature

For his deep understanding of his country's peasantry and the exquisite art with which he has portrayed their way of life and their relationship with Nature.

Sillanpää, Frans Eemil, b.—September 16, 1888, Kierikkala, Finland, d.—June 3, 1964, Helsinki. A Finnish writer born in a peasant family. He began to study natural sciences but in 1913 discontinued his studies and returned to his village, married and began to write.

His first short stories were published in journals during 1915. From 1924 to 1927 he worked for a publishing company in Porvoo. His first novel, *Elama ja aurinko* (1916, Life and Sun), is the story of a young man who returns home in midsummer and falls in love.

SILLANPÄÄ, FRANS EEMIL
Finland

Shocked by the Finnish Civil War of 1918, he wrote his most significant novel, *Hurskas kurjuus* (1919, Meek Heritage, 1938) and a volume of stories, *Enkelten Suojatit* (Wards of the Angels, 1923). His novelette *Hiltu ja Ragnar* (1923) is a tragic love story of a town boy and village servant girl. He published his best known work in 1931, *Nuorena nukkunut* (Fallen Asleep While Young; also known as the Maid Sailja, 1933) which depicts the story of a peasant family. *Miehen tie* (The Course of a Generation, 1932) is also based on a peasant topic. His most well-written novel is *Ihmiset Suviyeossae* (1934, People in the Summer Night).

He reminisced through *Polka eli elaemaeaensa* (1956) which threw new light on his personality.

1943

PHYSICS
Stern, Otto
CHEMISTRY
De Hevesy, George
PHYSIOLOGY OR MEDICINE
Dam, Henrik Carl Peter
Doisy, Edward Adelbert

1943

Physics

For his contribution to the development of the molecular ray method and his discovery of the magnetic moment of the proton.

Stern, Otto, b.—February 17, 1888, Sohrau, Germany, now Zory, Poland, d.—August 17, 1969, Berkeley, California. Stern studied at the University of Breslau and obtained his Ph.D. in 1912.

STERN, OTTO
Poland/USA

Afterwards, he worked with Einstein for two years. His early scientific work was theoretical studies of statistical thermodynamics. In 1914, he became a lecturer in theoretical physics at the University of Frankfurt and, in 1923, a professor of physical chemistry at the University of Hamburg. Two years after he performed his historic molecular beam experiment. By shooting a beam of silver atoms though a nonuniform magnetic field onto a glass plate, he found that the beam split into two distinct beams instead of broadening into a continuous band. This experiment verified the space quantization theory which stated that, atoms can align themselves in magnetic field only in a few directions instead of in any direction, as classical physicists had suggested. In 1933, Stern succeeded in measuring the magnetic moment of the proton by using a molecular beam and found that it was actually about two and a half times greater than the theoretical value. In 1933, with the rise of Nazis to power, Stern, a Jew, was compelled to leave Germany. He went to the USA, where he became research professor of physics at the Carnegie Institute of Technology and remained there until his retirement in 1943.

Chemistry

For his work on the use of isotopes as tracers in the study of chemical processes.

De Hevesy, George, b.—August 1, 1885, Budapest, d.—July 5, 1966, Freiburg-im-Breisgau, West Germany. He was educated in the gymnasium of the Piarist Order, from where he matriculated in 1903. He had his higher education at Budapest University and Berlin Technical University, and obtained his doctorate from the University of Freiburg-im-Breisgau in 1908.

De Hevesy worked as an assistant at the Institute of Physical Chemistry, Technical University of Switzerland, and thereafter spent a short period with Fritz Haber, Nobel Laureate in Chemistry (1918), observing his work on ammonia synthesis. In 1911, he began to work under Ernest Rutherford, Nobel Laureate in Chemistry (1908), on the chemical separation of radium. He interrupted this study and went to the Vienna Institute of Radium Research in 1913, to work with Fredrich Paneth on radioactive-tracer experiment. Here he obtained the Venia Legendi in the University of Budapest. He was drafted into the Austrian-Hungarian Army in 1915, and after the war taught for six months in the University of Budapest. He left for Copenhagen in 1919 to work in Niels Bohr's Institute.

In 1926, he became Professor of Physical Chemistry, University of Freiburg-im-Breisgau. He was an Associate of the Institute of Research in Organic Chemistry, and was elected Franqui Professor in the University of Ghent. He remained an active scientific associate after his retirement.

He married Pia Rüs in 1924. They have one son and three daughters.

De Hevesy's experiment to isolate radium D from radioactive lead, which he conducted with Rutherford in Manchester, was not successful. He later used radium D as a marker to determine the solubility of highly insoluble lead compounds, and successfully determined the exact quantity of lead sulphide or lead chromate taken up under different conditions from solvents of different types. By the precipitation of thorium B, a very active isotope of lead, he was able to measure the energy needed to liberate an atom from the crystallized part of the lead.

DE HEVESY, GEORGE
Hungary

Phosphorus is an extremely important element in biological process and its functions in living organisms could be studied with the help of radioactive markers. De Hevesy produced physiological solutions of sodium phosphate containing radioactive phosphorus, which was used as a marker, and injected them into animals and humans, and determined the distribution of the phosphorus. He succeeded in detecting where and at what speed the various organic compounds of phosphorus are able to form and the paths which they take in the animal organism. He also carried out several experiments with radioactive sodium and potassium. He used deuterium as marker in many tests. These experiments revealed the dynamic state of the constituents of a living body. In Freiburg, he was involved in the first clinical use of isotopes.

De Hevesy and Dirk Coster in 1923, in Copenhagen, discovered hafnium among the ores of zirconium, at the suggestion of Niels Bohr. When he became Professor at Freiburg, he determined the relative abundance of chemical elements. He demonstrated the formation of new artificially radioactive isotopes and subsequently introduced a method of activation analysis based on neutron bombardment of the element to be investigated. This method later replaced X-ray analysis with fluorescent X-rays. He studied the effect of X-rays on the formation of nucleic acid in tumours and in normal organs, and iron transport in healthy and cancerous organisms.

De Hevesy's published works include *Adventures in Radioisotope* (in two volumes) and *Adventures in Radioisotope Research* (1962, also in two volumes) in addition to many scientific papers.

He was the recipient of the Cannizaro Prize, Academy of Sciences, Rome (1929), the Copley Medal, Royal Society, London (1949), the Faraday Medal (1950), the Baily Medal (1951), and the Sylvanus Thompson Medal (1955). He received the Ford Foundation's Atoms for Peace Award Medal in 1959, and the Niels Bohr Medal and the Rosenberg Medal of the University of Chicago in 1961. He held honorary degrees from Uppsala, Freiburg, Copenhagen, Ghent, Liege, London, Capetown, Sao Paolo, Rio de Janeiro, and Turin. He was a Fellow of the Royal Society of London, the Swedish Academy of Sciences, Goettenburg Academy, and many other scientific academies. He was Honorary Fellow of the Chemical Society (London), Royal Institution (London), British Institute of Radiology, Finnish Chemical Society, German Bunsen Society, German Physiological Society, Chemical Society of Japan and the American Society of Nuclear Medicine.

Physiology or Medicine

For his discovery of vitamin K.

Dam, Henrik Carl Peter, b.—February 21, 1895, Copenhagen, d.—April 1976, Copenhagen. A biochemist, Dam shared with Edward A. Doisy the prize for 1943.

Dam and his associates (1929-34) demonstrated a deficiency disease in chicks characterized by a tendency to bleed and an increased blood-clotting time. He ascribed the disease to the lack of an antihaemorrhagic vitamin, which he later showed to be fat-soluble and present in green leaves. He named it vitamin K (Koagulations-vitamin). In 1939, he and Doisy, independently of each other, reported isolation of the vitamin from alfalfa hay.

DAM, HENRIK CARL PETER
Denmark

A graduate from the Polytechnic Institute of Copenhagen (1920), he taught at the School of Agriculture and Veterinary Medicine and the Physiological Laboratory of the University of Copenhagen. He studied microchemistry with F. Pregl (Nobel Laureate) in Graz, Austria. He was awarded a Ph.D. in biochemistry by the University of Copenhagen in 1934. During 1932-33 he studied in Schoenheimer laboratory at Freiburg, and later worked with Karrer (Nobel Laureate) at Zuerich in 1935. He went to the USA in 1940, lecturing and continuing his research, chiefly at the University of Rochester, New York. In 1946, he returned to Copenhagen as professor of biochemistry at the Polytechnic Institute and was later the head of the Danish Fat Research Institute.

◆

For his discovery of the chemical nature of vitamin K.

Doisy, Edward Adelbert, b.—November 13, 1893, Hume, Illinois. A biochemist, he shared the 1943 prize with Henrik Dam. Doisy and his associates also isolated a variant form of the vitamin, vitamin K_2, and the sex hormones oestrone (theelin, 1929), oestriol, the first oestrogen to be crystallized, (theelol, 1930) and oestradiol (dihydrotheelin, 1935).

DOISY, EDWARD ADELBERT
USA

After receiving his Ph.D. from Harvard University (1920), Doisy taught at Washington University School of Medicine, St. Louis, Missourie, where he worked with the embryologist Edgar Allen and developed techniques that facilitated his research on sex hormones. In recognition of his contributions to the knowledge of vitamins, antibiotics, hormones, and blood buffers, the university's department of biochemistry was named after him in 1955.

Besides his many publications in scientific periodicals, his books include *Sex Hormones* (1936) and *Sex and Internal Secretions* (1930), with Edgar Allen and Charles H. Danforth.

Note: The prize for 1943 was divided equally between Dam and Doisy.

1944

PHYSICS

Rabi, Isidor Isaac

CHEMISTRY

Hahn, Otto

PHYSIOLOGY OR MEDICINE

Erlanger, Joseph / Gasser, Herbert Spencer

LITERATURE

Jensen, Johannes Vilhelm

PEACE

Comité International de la Croix Rouge
(International Committee of the Red Cross)

1944

Physics

For his resonance method for recording the magnetic properties of atomic nuclei.

Rabi, Isidor Isaac, b.—July 29, 1898, Rymanow, Austrian Poland, now in Ukraine. Rabi came to the United States in his early childhood. He graduated from Cornell University in 1919 and obtained his Ph.D. from Columbia University in 1927.

RABI, ISIDOR ISAAC
Poland/USA

He joined the faculty of Columbia University in 1929 and became professor of physics in 1937. In that year he invented his magnetic resonance method, from which a number of fixed mechanical and magnetic properties as well as the shape of an atomic nucleus, may be deduced. His method also yielded detailed information about the structure of atoms and molecules.

From 1940 to 1945 he was involved in the development of microwave radar and was associate director of the Radiation Laboratory, Massachusetts Institute of Technology. He was a member of the General Advisory Committee of Atomic Energy Commission and its chairman for four years. He was active in arranging the International Conference on Peaceful Uses of Atomic Energy in 1955, 1958, and 1964. As a US representative to the UNESCO, he originated the movement that resulted in the international laboratory for high-energy physics in Geneva known as CERN. He was one of the founders of the Brookhaven National Laboratory. He was appointed to the general advisory committee for the US Arms Control and Disarmament Agency in 1962 and in 1964 became the first university professor at Columbia.

Chemistry

For his discovery of the fission of heavy nuclei.

Hahn, Otto, b.—March 8, 1879, Frankfurt-am-Main, d.—July 28, 1968, Göttingen. He studied at the University of Marburg and graduated with a doctorate in science in 1901. He worked on radioactivity under Ernest Rutherford (Nobel Laureate) in Montreal and Sir William Ramsay (Nobel Laureate) in London. Soon after his return to Germany in 1906 he was made the Director of the prestigious Kaiser Wilhelm Institute for Chemistry. He was a brilliant theoretician but was dogged by a sense of modesty which in later years would lead him to understate or even withhold his most important discoveries.

Soon after his appointment at the Kaiser Wilhelm Institute he met Lise Meitner, an Austrian radio-physicist, with whom he formed a remarkable research partnership which was to last for more than 30 years. Meitner's personality was more forceful and she encouraged the diffident

Hahn and as a team they made many important contributions to our knowledge of atomic nuclei.

HAHN, OTTO
Germany

Hahn was fascinated with the behaviour of uranium when bombarded by slow neutrons in which neutron-capture appeared to occur, so forming the next heavier element. Hahn and Meitner pursued their work and came to the conclusion that the bombardment of uranium did in fact produce transmuted atoms of some other element. They were soon joined by Fritz Strassman. In 1938 Meitner, whose Jewish ancestry made it unsafe for her to remain in Germany, left for Holland, finally settling in Stockholm.

Initially, Hahn and Strassman believed that a new isotope of radium was being created, because Joliot-Curie (Nobel Laureate) and P. Savitch were unable to account for some radioactivity observed in a similar bombardment. But their experiments showed this to be unlikely and they soon discovered that a radioactive form of the metal barium was being created. Hahn realized that something very strange must be taking place. The only mechanism he could think of to explain this phenomenon was a process by which nuclei of uranium atoms actually broke up to form nuclei of much lighter atoms, at the same time emitting neutrons and a large amount of energy. He called the process "nuclear fission".

If Meitner had not left Germany, she would have imbibed in him the courage he needed to publish his discovery. With Meitner being away in Sweden, Hahn was unsure of his interpretation of the results and feared ridicule in publishing such a revolutionary theory. But Meitner being what she was took the decision for him and from Stockholm clarified the results and published Hahn's work on fission in a leading scientific journal.

Immediately, the process of nuclear fission was seized upon as the working principle for a nuclear reactor and the first successful prototype was built in Chicago in 1942 by Enrico Fermi.

Soon, to his horror, he found that his work was being utilized for highly destructive purposes in the form of atomic bombs. He found it extremely difficult to live with this sense of guilt and seriously contemplated suicide. He, however, overcame this and became active in the cause of nuclear disarmament.

In 1944, Hahn along with other German nuclear scientists was taken to England. On his return in 1946 he became the President of the Max Planck Society and assisted in the post-war rehabilitation of German science. In 1960 his only son died in a car accident and he spent his last few years caring for his invalid wife and grandson.

Hahn was widely honoured by many universities and learned societies. His name is commemorated in the Hahn-Meitner Institute for Nuclear Research in Berlin, Otto Hahn Institute for Chemistry at Mainz and in West Germany's first nuclear vessel, *Otto Hahn*. He shared the 1966 Enrico Fermi award with Strassman and Lise Meitner.

Physiology or Medicine

For their discoveries relating to the highly differentiated functions of single nerve fibres.

Erlanger, Joseph, b.—January 5, 1874, San Francisco, d.—December 5, 1965, St. Louis, Missourie. He graduated in chemistry from the University of California and received in 1899 his MD degree from Johns Hopkins University. A physiologist, he shared with his student Herbert Gasser the prize for discovering that fibres in the same nerve trunk possess different functions. Soon after his appointment as professor of physiology at Washington University (St. Louis), Gasser joined him there, and they began studying ways in which the recently developed field of electronics could be applied to physiological investigations.

ERLANGER, JOSEPH
USA

By 1922, they were able to amplify the electrical responses of a single nerve fibre so that they could analyze them by the use of a cathode-ray oscilloscope. The characteristic wave pattern of an impulse generated in a stimulated nerve fibre, once amplified, could then be seen on the screen and the components of the nerve's response studied.

In 1932, Erlanger and Gasser found that the fibres of a nerve conduct impulses at different rates, depending upon the thickness of the fibre and that each fibre has a different threshold of excitability, i.e., each requires a stimulus of varying intensity to create an impulse. They also found that different fibres transmit different kinds of impulses, represented by different types of waves.

◇

For their discoveries relating to the highly differentiated functions of single nerve fibres.

Gasser, Herbert Spencer, b.—July 5, 1888, Platteville, Wisconsin, d.—May 11, 1963, New York City. After attending the State Normal School he went to the University of Wisconsin, where he graduated A.B. in 1910 and A.M. in 1911. He studied physiology under Erlanger. He then went to the Johns Hopkins Medical School for his clinical studies, obtaining his M.D. in 1915. After a year in pharmacology at Wisconsin he went to Washington University (St. Louis), where he was associated with Erlanger, becoming professor of pharmacology in 1921.

When he was at the Johns Hopkins Medical School, Gasser worked for a time on a problem concerning blood coagulation. His major work, however, began with his collaboration with Erlanger and was concerned with the electrophysiology of the nerves. His first paper dealt with action currents in the phrenic nerve. Later the newly perfected low-voltage cathode-ray oscillograph was utilized in the work. Soon it was possible to demonstrate that the complexity of the oscillograph results was due to the different conductivity rates of different groups of nerve fibres. The work led to advances in our knowledge of the mechanism of pain and of reflex action and has inspired many neurophysiologists.

GASSER, HERBERT SPENCER
USA

Gasser was the co-author of *Electrical Signs of Nervous Activity* (1937). He published many scientific papers on neurophysiological topics. He was Editor of *The Journal of Experimental Medicine* in 1936.

Note: The prize for 1944 was awarded jointly to Erlanger and Gasser.

Literature

For the rare strength and fertility of his poetic imagination with which is combined an intellectual curiosity of wide scope and a bold, freshly creative style.

Jensen, Johannes Vilhelm, b.—January 20, 1873, Farsoedin, Denmark, d.—November 25, 1950, Copenhagen. A novelist, poet, essayist and writer of many mythical stories. In his later life he tried to depict man's development in the perspective of Darwin's theory of human evolution and was very much criticised.

JENSEN, JOHANNES VILHELM
Denmark

He made his first impression as a writer through *Himmerlandshistorier* (Tales from the Himmerland, 1898-1910), a travel anecdote from his travels in the Far Eastern countries. He published more than 100 tales under the title *Mytr* (Myths, 1907-45) and his stories and his first novel *Danskere* (Danes, 1896) were published in *Revunen* and *Nordiske Forlag*.

In 1898, he went to Spain as a war correspondent of *Politiken* to cover the Spanish-American War which resulted in the masterpiece that made him famous, *Tyrefaegtningen* (The Bullfight, 1898). In 1906, he became the editor of a daily *Pressen*, and published a volume of poems.

In the next 14 years he produced six novels with the common title *Den lange rejse* (1908-22, The Long Journery, 1922-24), the series is considered to be his best writing. His later works include *Evolution of Moral* (1925), *Dyrenes Forvandling* (The Metamorphosis of Animals, 1927), and *Vor Oprindelse* (Our Origin, 1941). In 1943, *Digte 1904-41* (Poems), his last major work, appeared.

Peace

COMITÉ INTERNATIONAL DE LA CROIX ROUGE (INTERNATIONAL COMMITTEE OF THE RED CROSS)

Geneva

After the termination of hostilities during World War II the prize was awarded to the International Red Cross Committee in 1944. The Committee represents all the Red Cross organizations of the world and is located at Geneva, Switzerland.

1945

PHYSICS
Pauli, Wolfgang

CHEMISTRY
Virtanen, Artturi Ilmari

PHYSIOLOGY OR MEDICINE
Chain, Ernst Boris / Fleming, Sir Alexander
Florey, Howard Walter

LITERATURE
Gabriela, Mistral

PEACE
Hull, Cordell

1945

Physics

For the discovery of the Exclusion Principle, also called the Pauli Principle.

Pauli, Wolfgang, b.—April 25, 1900, Vienna, d.—December 15, 1958, Zuerich. When he was only 20, he wrote a 200-pages encyclopedic article on the theory of relativity. He was appointed a lecturer at the University of Hamburg in 1923, and the following year he proposed that a fourth quantum number was needed in the quantum theory and that it may take on the numerical value $\frac{1}{2}$ or $\frac{1}{2}$. It was later found that the two values represent the two possible directions of spin for fermions. In 1925, he introduced his exclusion principle which, when applied to electrons, immediately made clear the reason for the structure of the periodic table of the elements.

PAULI, WOLFGANG
Austria

In 1928, he became professor of theoretical physics at the Federal Institute of Technology at Zurich. Under his direction the institution became a great centre of research in theoretical physics during the years preceding World War II. In the late 1920s it was observed that when a beta particle is emitted from an atomic nucleus, there is generally some energy and momentum missing, a grave violation of the laws of conservation of energy. In 1931, Pauli proposed that the missing energy and momentum are carried away from the nucleus by some particle (which was named the "neutrino" by the Italian Nobel Laureate physicist, Fermi) that is uncharged and has little or no mass. Furthermore, the postulated particle had gone unnoticed because it interacts with matter so seldom that it is nearly impossible to detect.

In 1940, Pauli was appointed to the chair of theoretical physics at the Institute for Advanced Study, Princeton University, New Jersey and in 1946 he became a naturalized citizen of the US. Following the World War II he again returned to Zürich.

Chemistry

For his research and inventions in agricultural and nutrition chemistry, especially for his fodder preservation method.

Virtanen, Artturi Ilmari, b.—January 15, 1895, Helsinki, d.—November 11, 1973, Helsinki. A biochemist whose investigations directed toward the amelioration of protein rich green fodder production and storage, vitally important to regions having long and severe winters. He was a chemistry instructor at the University of Helsinki, where he became professor of biochemistry. He studied the fermentation processes which spoil grains or fodder stored in silos.

Knowing that the product of fermentation, lactic acid, increases the acidity of the stored grains or fodder to a point at which further destructive fermentation stops, he developed a procedure (known by his own initials, AIV) for the addition of measured quantities of dilute hydrochloric and sulfuric acids to newly stored fodder or grains in a silo which increase the acidity of the fodder or grain beyond the fermentation point. In a series of experiments, he showed that the acid treatment had no adverse effect on the nutritive value and edibility of the fodder and of products derived from animals fed with the fodder. He was professor of biochemistry at the Finnish Institute of Technology, Helsinki, and director of the Biochemical Research Institute, Helsinki. Virtanen also conducted valuable research on the nitrogen-fixing bacteria found in the root nodules of leguminous plants; on improved methods of butter preservation, and on economical, partially synthetic cattle feeds. His AIV system as the basis of preservation of cattle feeds appeared in 1943 and is now practised universally in all cold countries of the world.

VIRTANEN, ARTTURI ILMARI
Finland

Physiology or Medicine

For the discovery of penicillin and its curative effect in various infectious diseases.

Chain, Ernst Boris, b.—June 19, 1906, Berlin. d.—August 12, 1979, Ireland. A biochemist who with Howard Walter Florey isolated and purified penicillin (discovered in 1928, by Sir Alexander Fleming) and performed the first clinical trials of the antibiotic. For this work the two shared the prize with Fleming.

CHAIN, SIR ERNST BORIS
Germany/Great Britain

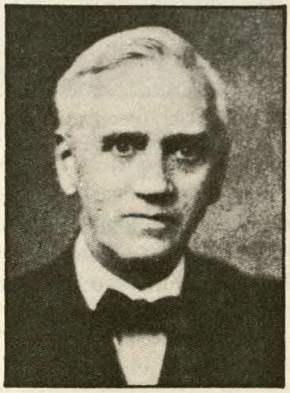
Chain graduated in chemistry and physiology from the University of Berlin, and, after a period of research at the Institute of Pathology, Charite Hospital, Berlin, he went to Cambridge University and worked under Sir Frederick G. Hopkins (Nobel Laureate). He then went to Oxford, where he worked with Florey on penicillin. In 1948, he became scientific director of the International Research Centre for Chemical Microbiology, Institute Superiore di Sanita, Rome.

He was elected Fellow of the Royal Society in 1949.

◆

For the discovery of penicillin and its curative effect in various infectious diseases.

Fleming, Sir Alexander, b.—August 6, 1881, Lochfield, Ayrshire, Scotland, d.—March 11, 1955, London. Fleming was a farmer's son and was first educated at the local village school and then at Kilmarnock Academy. When Fleming was 13, his father died, and he went to live with an elder brother in London who was a medical practitioner. He continued his education for three years at the Polytechnic Institute in Regent Street. He spent four years in a shipping office before entering St. Mary's Medical School, London University. He qualified with distinction in 1906 and began research at St. Mary's under Sir Almroth Wright, a pioneer in vaccine therapy. He gained M.B.B.S. (London) as a Gold Medalist in 1908, and was a lecturer at St. Mary's until 1914. He served throughout World War I as a captain in the Royal Army Medical Corps, being mentioned in despatches, and in 1918 he returned to St. Mary's. He was elected Professor of the School in 1928. Fleming was elected Fellow of the Royal Society in 1943 and knighted in 1944. He retired in 1948 as Professor Emeritus but continued as Principal of Wright-Fleming Institute of Microbiology that had been founded in honour of him and his famous colleague.



FLEMING, Sir ALEXANDER
Great Britain

In 1928, while working on *staphylococci*, he noticed that a culture of staphylococcus had become accidently infected with a mould. Around the mould colony, the staphylococci and disappeared, and Fleming correctly attributed this to the production of an antibacterial substance by the mould. He isolated the mould and grew it in pure culture in broth and discovered that after a few days the broth had acquired a high antibacterial activity. He soon found that a number of pathogenic bacteria were destroyed by it, and white blood corpuscles were little, if at all, sensitive to it. The mould Fleming used was a strain of the fungus *Penicillium* and he called the substance secreted by this "penicillin".

Fleming was not successful in isolating penicillin in sufficient quantities since it proved to be very unstable and he also lacked the facilities for this. Ten years passed and with the breaking out of World War I scientists were once again concerned with the problem of infected wounds. His work was taken up by Howard Florey, an Australian born pathologist, and Ernst Chain, a German biochemist. At that time they were both working at Oxford University, where there happened to be some samples of penicillin available. They eventually succeeded in stabilising the structure of penicillin. They also found that it was completely harmless to the tissues and that it needed to be administered over a period of several days to have the desired effect since it was rapidly excreted by the body.

The work done by Florey and Chain years after Fleming's discovery proved the importance and significance of his work. Penicillin is one of the most useful drugs known to man today.

Shortly before his death from a heart attack, Fleming said, "Everywhere I go people want to thank me for saving their lives. I really don't know why they do it. Nature created Penicillin, I only found it." ◆

For the discovery of penicillin and its curative effect in various infectious diseases.

Florey, Howard Walter, b.—September 24, 1898, Adelaide, Australia, d.—February 21, 1968, Oxford. A pathologist who with Ernst Boris Chain isolated and purified penicillin (discovered in 1928 by Sir Alexander Fleming) for general clinical use.

FLOREY, HOWARD WALTER
Australia/Great Britain

Florey studied medicine at Adelaide and Oxford universities. After holding teaching and research posts at Cambridge and Sheffield universities, he became professor of pathology at Oxford in 1935. Florey was made provost of Queen's College, Oxford, in 1962, and a life peer in 1965.

Florey investigated tissue inflammation and secretion of mucous membranes. He succeeded in purifying *lysozyme*, a bactericidal enzyme found in tears and saliva, and characterized the substances acted upon by the enzyme. In 1939, he surveyed other naturally occurring antibacterial substances, concentrating on penicillin. With Chain, he demonstrated its curative properties in human studies and developed methods for production. Following World War II and the work of his research team in North Africa, penicillin came into widespread clinical use.

He was President of the Royal Society and a Fellow of the Royal College of Physicians, and among other honorary fellowships he held was that of the Royal Australian College of Physicians.

Note: The 1945 prize was awarded jointly to Fleming, Chain and Florey.

Literature

For her lyric poetry which, inspired by powerful emotions, has made her name a symbol of the idealistic aspirations of the entire Latin American world.

Gabriela, Mistral, b.—April 7, 1889, Vicuna, Chile, d.—January 11, 1957, Hampstead, New York. She was the founder of the modernist movement in Chile through poetry. She was of Spanish, Basque and South American Indian descent. She grew up in a small village of northern Chile and became a school teacher at 15. She was later promoted to the rank of a college professor.

Her diplomatic assignments included postings in Madrid, Lisbon, Genoa and Nice. Her reputation as a poet was established in 1914 when she won a Chilean prize for *Sonetos de la Muerte* (Sonnets of Death). Those were signed by her pseudonym adapted from the names of two of her favourite poets, the Italian Gabriele D' annunizio and the Frenchman Frederic Mistral. A collection of her early works *Desolacion* (1922, Desolation) includes the poem *Dolor* detailing her unsuccessful love-affair ending in the suicide of her lover. She never married. *Ternura* (1924, Tenderness), *Tala* (1938) and *Lagar* (Wine Press, 1954) reflect her love for poor and downtrodden children.

GABRIELA MISTRAL (pen name of GODOY Y. ALCAYAGA, LUCILA)
Chile

She served on the sociological and cultural committees of the League of Nations and the United Nations. She was the first woman of Latin America to be honoured with the prize.

Peace

Hull, Cordell, b.—October 2, 1871, Pickett country, Tennessee, d.—July 23, 1955, Bethesda, Maryland. The US Secretary of State whose initiation of the reciprocal trade program to lower tariffs set in motion the mechanism for expanding world trade in the 20th century. He received the prize for his part in organizing the United Nations. As a young attorney, he was affiliated to the Democratic Party, representing his district in the US House of Representatives for 22 years, and in the Senate. He also served as Chairman of the Democratic National Committee. He was influenced by the philosophy of President Woodrow Wilson, and came to believe that lower trading duties and removal of other trade barriers comprised the foundation of world peace.

He was appointed Secretary of State by President Franklin D. Roosevelt at the beginning of the New Deal and he called for a reversal of high tariff barriers that had increasingly affected the nation's foreign trade since the 19th century. He first won presidential support and public acclaim for such proposals at the inter-American Monte-

HULL, CORDELL
USA

video Conference. He next succeeded in getting the US Congress to pass the Reciprocal Trade Agreements Act, which set the pattern for tariff reduction by agreement on a most-favoured-nation basis and was a forerunner to the international General Agreement on Tariffs and Trade (GATT), which began in 1948. Throughout the 1930s Hull did much to improve US relations with Latin America by implementing what came to be known as the "Good Neighbour Policy".

With the outbreak of World War II, Hull and Roosevelt felt that efforts to maintain neutrality would only encourage aggression by the Axis powers; they therefore substituted aid to the Allies. In the crucial negotiations with Japan in the autumn of 1941, Hull stood firmly for the rights of China. In a final note he invited Japan to abandon its military conquests on the mainland of China.

When the USA entered the war, Hull and his State Department colleagues began planning an international postwar peace-keeping body. At the Moscow Conference of Foreign Ministers he obtained a four-nation pledge to continue wartime cooperation in a postwar world organization aimed at maintaining peace and security. President Roosevelt described Hull as "Father of the United Nations". He resigned after the 1944 presidential election, having served nearly 12 years longer than any of his predecessors.

1946

PHYSICS

Bridgman, Percy Williams

CHEMISTRY

Northrop, John Howard
Stanley, Wendell Meredith
Sumner, James Batcheller

PHYSIOLOGY OR MEDICINE

Muller, Hermann Joseph

LITERATURE

Hesse, Hermann

PEACE

Balch, Emily Greene / Mott, John Raleigh

1946

Physics

For the invention of an apparatus to produce extremely high pressures, and for the discoveries he made therewith in the field of high pressure physics.

Bridgman, Percy Williams, b.—April 21, 1882, Cambridge, Massachusetts, d.—August 20, 1961, Randolph, New Hampshire. An experimental physicist noted for his studies of materials at high temperature and pressures. After education in the public school at Newton, Massachusetts, Bridgman entered Harvard University in 1900 and obtained his Ph.D. in 1908. Thereafter he joined the faculty of Harvard and attained professorial position in 1913 and continued there till his retirement in 1954.

BRIDGMAN, PERCY WILLIAMS
USA

As a teacher at Harvard from 1908, Bridgman developed most of the apparatus needed to test his theories of matter under high pressures. He developed apparatus to produce pressures of 20,000 atmospheres by using stronger materials and by putting pressure on the container from outside. As a consultant at General Electric Company, he and his group succeeded in producing synthetic diamonds by the use of high temperature and high pressure in 1955. His analysis of phase transitions in mineral systems provided insight into the structure and composition of the earth's interior. His scientific papers were published in *Collected Experimental Papers* (7 vols., 1964). He is also noted for his writings on the philosophy of science.

Chemistry

For their preparation of enzymes and virus proteins in a pure form.

Northrop, John Howard, b.—July 8, 1891, New York, d.—May 27, 1987, Wickenburg, Arizona. He is a direct descendant of Joseph Northrop who settled in New Milford, Connecticut in 1639, of Jonathan Edwards, President of Princeton University, 1758, and of Frederick C. Havemeyer, whose family presented Havemeyer Hall, the Chemical Laboratory, to Columbia University. His father, John I. Northrop, an instructor at Columbia, was fatally injured in a laboratory accident shortly before his death. His mother, Alice R. Northrop, who formally taught botany at Hunter College, New York, was instrumental in the introduction of nature study into the curriculum of New York public schools. His former country home in Massachusetts is maintained by the "Northrop Memorial" as a school of nature study for New York school children.

Northrop married Louise Walker in 1917; they had one son and one daughter. His son, John, is an oceanographer, and his daughter, Alice, married Professor Frederick C. Robbins, Nobel laureate (1954).

NORTHROP, JOHN HOWARD
USA

Northrop studied in a public school, and in 1908 joined Columbia University to study zoology and chemistry under T.H. Morgan, Nobel laureate in Physiology or Medicine, 1933, and J.M. Nelson. He obtained his B.Sc. in 1912, Master of Arts in 1913, and Ph.D. in Chemistry in 1915. In 1916, with a W.B. Cutting Travelling Fellowhip, he worked in Jacques Loeb's laboratory at the Rockefeller Institute, where he was appointed to the staff the following year. During 1917-18 he served as a captain in the chemical warfare service. He became an Associate Member in 1924 of the Rockefeller Institute. He was appointed in 1949 Professor of Bacteriology, University of California, and later, Professor of Biophysics.

Northrop began work on the purification of the protein-splitting enzymes found in the digestive apparatus and gradually succeeded in obtaining a number of them in crystallized form. He and his colleagues, especially Kunitz, also made extremely comprehensive studies of the homogeneity and purity of these purified enzymes, and gave further proof that they are proteins. His extensive studies led finally to the crystallization of enzymes.

His earlier work was connected with theories of duration of life. He discovered a fermentation process for the manufacture of acetone, which he developed to the pilot-plant stage. He worked with Loeb on a kinetic study of enzymes essential to life processes. Northrop also studied the proteins of viruses and antibodies, and suggested that viral activity was due to nucleic acid, which was later proved to be correct. As consultant to the National Defence Research Committee during World War II he studied the mode of action of water gases and methods of detection. He also worked on the origin and relationship of viruses and the transforming principle.

Northrop has written a number of scientific papers. In 1939, he published a book, *Crystalline Enzymes*. For some years he edited the *Journal of General Physiology*, published by the Rockefeller Institute.

He received honorary degrees from a number of universities including Harvard, Columbia, Yale, and Princeton. He received the Stevens Prize, Columbia (1931), Chandler Medal (1936), Daniel Girand Elliot Medal (1939), Certificate of Merit, US Government (1948) and the Alexander Hamilton Medal (1961).

Northrop's interests were hunting and shooting. He was also fond of riding and sailing, and played golf and tennis.

◇

For their preparation of enzymes and virus proteins in a pure form.

Stanley, Wendell Meredith, b.—August 16, 1904, Ridge Ville, Indiána, d.—June 15, 1971, Salamanca, Spain. He graduated in 1926 from Earlham College and then joined the University of Lllivaris. Here he obtained his Master of Science degree in 1927 and a Ph.D. in Chemistry in 1929. Stanley was a research associate in the University of Illinois before he left for Munich to do research

STANLEY, WENDELL MEREDITH
USA

as a National Research Council Fellow in 1930.

In 1931 Stanley returned to the US and became an Assistant at the Rockefeller Institute, where he remained until 1948, becoming an Associate Member in 1937, and a full Member in 1940. In 1948, he was appointed Professor of Biochemistry and Director of the Virus Laboratory, University of California. He was Chairman of the Department of Biochemistry during 1948-53, and in 1958 he was appointed Professor of Virology.

Stanley married in 1929; they had one son and three daughters.

Stanley worked on the chemical nature of the viruses. Viruses are known for a large number of illness in man, animals and plants. They cannot be seen under the microscope, and when Stanley began his work they could only be identified by the symptoms of disease which they caused. In 1945, by using large quantities of infected tobacco leaves, he succeeded in producing small amounts of crystals which were extremely active and which, after detailed investigations, proved to be the bearers of the activity of the virus. He also proved the proteinaceous nature of these viruses. Subsequent work has shown that nucleic acid also forms an important constituent. He was an authority on viruses, recognized all over the world. His work enabled scientists, utilizing methods of X-ray diffraction, to ascertain the precise molecular structure and the modes of propagation of several viruses.

Stanley has written over 150 papers on viruses and contributed chapters to several books.

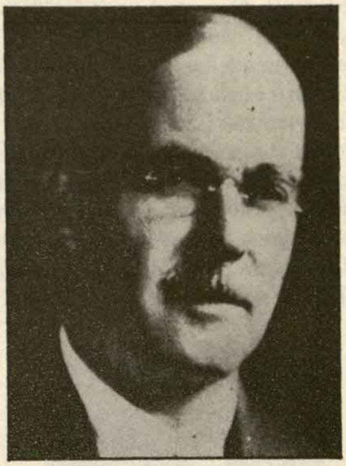
He won many awards and medals including honorary degrees from Harvard, Yale, Princeton and Illinois.

◆

For his discovery that enzymes can be crystallized.

Sumner, James Batcheller, b.—November 19, 1887, Canton, Massachusetts, d.—August 12, 1955, Buffalo, New York. Sumner was the son of a wealthy cotton manufacturer and farmer. He lost his left arm in a hunting accident in childhood which proved to be a handicap in his later life.

He studied chemistry and physiology at Harvard. He got his Ph.D. in 1914 and the same year he joined the staff of the Medical School at Cornell University, Ithaca, New York. He was appointed Professor of Biochemistry in 1929 and remained in Cornell University until shortly before his death. In 1947 he became Director of the Cornell Laboratory of Enzyme Chemistry which was established in recognition of his outstanding work. He was married thrice and had seven children.



SUMNER, JAMES BATCHELLER
USA

Sumner was the first to crystallise an enzyme, an achievement that led to the knowledge of protein nature of enzymes. Much of his work was done with the enzyme urease present in the jackbean, whose activity was easily estimated by ammonia analysis. In 1926 a simple change of procedure, from using aqueous ethanol to using aqueous acetone as a solvent gave him a crystalline product which, he concluded, was pure urease. It answered all the tests for proteins, thus confirming the views of those biochemists who believed that enzymes were nothing but proteins of special type.

Sumner's work was not appreciated and many biochemists did agree with him. But the eventual isolation of a number of other enzymes in the form of crystals, particularly pepsin by J.H. Northrop in 1930, justified Sumner's work. He crystallized the enzyme catalase in 1937 and also contributed to the purification of several other enzymes.

Note: The 1946 prize was awarded jointly to Northrop, Stanley and Sumner.

Physiology or Medicine

For the discovery of the production of mutations by means of X-ray irradiation.

Muller, Hermann Joseph, b.—December 21, 1890, New York City, d.—April 5, 1967, Bloomington, Indiana. Muller was brought up in Harlem. He first attended a public school in Harlem and later Morris High School in Bronx. In Bronx, he and his classmates Lester Thomson and Edgar Alterburg founded what was perhaps the first high school science club. He was awarded in 1907 the Cooper-Hevitt Scholarship and with the help of this he could enter Columbia University. He decided at this early stage that he wanted to make genetics his life-study.

MULLER, HERMANN JOSEPH
USA

After a short period at Cornell Medical College, he returned to Columbia University as a lecturer (1912-15). He was called by Julian Huxley to the Rice Institute, Houston, as instructor in 1915, where he remained until 1918. He taught varied biological courses and began studies on mutation. In 1918 he returned to Columbia University as instructor, and elaborated method for quantitative mutation study. He was appointed Associate Professor at Austin University, Texas, in 1920 and as Professor in 1925. In 1932 he went to Berlin to continue his researches with N.W. Timofeff-Resovsky, and then spent three years in Russia doing genetic research in the Academy of Sciences, first in Leningrad and then in Moscow. The growing intrusion of politics into his field of research forced him to leave Russia. He then continued his research at Edinburgh (1937-40), and in the United States at Amherst College (1942). Finally, in 1945, he took up his last academic appointment, as Professor of Zoology in the University of Indiana.

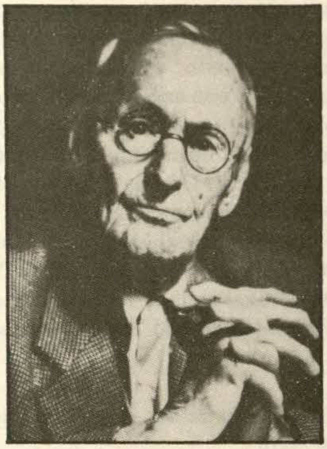
Muller formulated the chief principles of spontaneous gene mutation. His great contribution to genetics resulted from his careful quantitative studies of rates of mutation, under both natural and artificial conditions. He showed temperature to have an effect, and later in 1927 carried out classical experiments demonstrating the effects of X-rays, which may increase the mutation rate as much as 150 times. This opened up avenues to numerous researches, many of which were carried out with the aid of his students and co-workers. His own experience of the far-reaching genetic effect of irradiation of the germ cells, after leading to lethal mutations, led him to campaign against the dangers of such irradiation for the human race.

Literature

For his inspired writings which, while growing in boldness and penetration exemplify the classical humanitarian ideals and high qualities of style.

Hesse, Hermann, b.—July 2, 1877, Calw, Wuerttemberg, Germany, d.—August 9, 1962, Montagnola, Switzerland. A novelist and poet. The main theme of his works is man's breaking out of the established modes of civilization to find his inner spirit. With his appeal for self-realization and his aura of oriental mysticism he became a cult-figure to the angry generation of young men in the German and English-speaking world.

He was born near the Black Forest. At the instance of his father who was a missionary in India, he entered the Maulbronn Seminary. He was a model student but suddenly ran away after six months. He later joined as an apprentice in a tower-clock factory and then in a book store at Tubingen. His disgust with the restrictions of conventional schooling was expressed in *Unterm Rad* (1906, Beneath the Wheel, 1958), in which he portrayed an overtly diligent student who is driven to self-destruction due to despair and depression.



HESSE, HERMANN
Germany/Switzerland

He remained in the bookselling business until 1904, then he became a freelance writer and published in many journals and brought out his first novel *Peter Camenzind* in 1904. His later publications include *Gertrude* (1910), *Rosshalde* (1914), and the short story, *Knulp* (1915). He made a visit to India and wrote *Siddharta* (1922, English, 1951), a lyrical novel based on the early life of Buddha. The story was later successfully filmed in India under the same name.

During World War I he lived in Switzerland and openly criticized militarism and ultra nationlism, and edited a journal for the German prisoners of war and the internees. He became a permanent resident of Switzerland in 1919 and a citizen in 1923, settling in the small town of Montagnola. The shock of war-devastated Europe and the prolonged sickness of his youngest son and first wife, the death of his father and his own torments compelled him to take resort to psychiatric help in a sanatorium near Lucerne. He underwent prolonged psychoanalytical sessions, the influence of which is reflected in *Demian* (1919, English 1923). *Der steppenwolf* (1927, English, 1929) is one of his most inventive novels.

In his last and the longest novel *Das Glasperlenspiel* (1943, English, 1949) his dual personality is revealed. His collections of poems are *Trost der Nacht* (1929) and *Neue Gedichte* (1937).

Peace

Balch, Emily Greene, b.—January 8, 1867, Jamaica Plain, Massachusetts, d.—January 9, 1961, Cambridge. A sociologist, political scientist, economist, and pacifist, a leader of the women's movement for peace during and after World War I. She received the prize jointly with John Mott. She was noted for her sympathetic and thorough study of Slavic immigrants in the USA.

She was a member of the first graduating class at Bryn Mawr College. She taught at the Wellesley College, founded a settlement house in Boston and served on the Massachusetts commissions on industrial relations and immigration and the Boston city planning board.

BALCH, EMILY GREENE
USA

As a member of the Society of Friends, she was a delegate to the International Congress of Women in The Hague, and helped found the Women's International League for Peace and Freedom, of which she was secretary-treasurer. At the Neutral Conference on Continuous Mediation in Stockholm, she proposed a kind of international administration of former colonies similar to the mandate system adopted after World War I. For opposing US entry into the World War I, she was dismissed from her professorship at Wellesley College. Realizing the intractability of Nazi Germany and Japan, she approved the participation of the USA in World War II. Her writings on peace include *Approaches to the Great Settlement* (1918).

MOTT, JOHN RALEIGH
USA

Mott, John Raleigh, b.—May 25, 1865, Livingston Manor, New York, d.—January 31, 1955, Orlando, Florida. A Methodist Layman and evangelist who shared the prize with Emily Greene Balch for his work in international church and missionary movements. Mott became a student secretary of the International Committee of the Young Men's Christian Association, a position he held from 1888 to 1915. He was one of the organizers of the World Missionary Conference (Edinburgh, 1910), which marked the beginning of the modern ecumenical movement. He was chairman of the Student Volunteer Movement for Foreign Missions and of the International Missionary Council and president of the World's Alliance of YMCA's. His many writings include *The Future Leadership of the Church* (1909) and *The Larger Evangelism* (1944).

Note: The 1946 prize was divided equally between Balch and Mott.

1947

PHYSICS

Appleton, Sir Edward Victor

CHEMISTRY

Robinson, Sir Robert

PHYSIOLOGY OR MEDICINE

Cori, Carl Ferdinand / Cori, Gerty Theresa
Houssay, Bernardo Alberto

LITERATURE

Gide, André Paul Guillaume

PEACE

The Friends Service Council

1947

Physics

For his investigations of the physics of the upper atmosphere especially for the discovery of the so-called Appleton layer.

Appleton, Sir Edward Victor, b.—September 6, 1892, Bradford, Yorkshire, d.—April 21, 1965, Edinburgh. He won the prize for his discovery of the so-called "Appleton layer" of the ionosphere, which is a dependable reflector of radio waves and as such is useful in telecommunications. Other ionospheric layers also reflect radio waves, depending upon temperature and time of day. He was educated at St. John's College, Cambridge, and worked at the Cavendish laboratory under the noted physicists J.J. Thomson and Rutherford from 1920 until he was appointed the Wheatstone professor of physics at King's College, London, in 1924. There he attained an international reputation for his research into the propagation of electromagnetic waves and the characteristics of the ionosphere. He showed that radio waves of sufficiently short wavelength penetrated the lower region of the ionosphere and are reflected by an upper region. The discovery made more reliable long-range radio communication possible and aided in the future development of radar. In 1936, he came back to Cambridge as the Jacksonian Professor of Natural Philosophy and in 1939 became secretary to the Department of Scientific and Industrial Research, where he worked on radar and the atomic bomb during World War II. The Royal Society elected him Fellow in 1927. He was president of the International Scientific Radio Union during 1938-54 and promoted international cooperation for upper atmospheric research. He was knighted in 1941 and became principal and vice-chancellor of Edinburgh University in 1949.

APPLETON, SIR EDWARD VICTOR
Great Britain

Chemistry

For his investigations on plant products of biological importance, especially the alkaloids.

Robinson, Sir Robert, b.—September 13, 1886, near Chesterfield, Derbyshire. d.—February 8, 1975, Great Missenden, near London. Robinson's father was a surgical dressing manufacturer. He attended the Chesterfield Grammar School and Fulcheck School, near Leeds. He took his B.Sc. degree in 1906 and D.Sc. in 1910 from Manchester University.

In 1912, Robinson was appointed the first Professor of Pure and Applied Organic Chemistry, University of Sydney. He became Professor of Organic Chemistry at the University of Liverpool in 1915, in 1920 he was appointed Director of Research at the British Dyestuffs Corporation, and the next year Professor of Chemistry at St. Andrews. In 1922 he took the Chair in Organic Chemistry at Manchester University, and in 1928 a similar post in the University of London. He was Professor of Chemistry at Oxford from 1930 to 1955. The same year he was appointed Emeritus Professor and Honorary Fellow of Magdalen College.

Robinson married Gertrude Mand Walsh in 1912. She was his fellow student at Manchester University, and collaborated in several fields of chemical research especially in the survey of anthocyanins. She died in 1954. They had one son and one daughter.

ROBINSON, Sir ROBERT
Great Britain

His researches dealt with the structure and synthesis of many organic compounds, and formulated the qualitative electronic theory of organic molecular structure which was new in contemporary science.

Robinson solved the riddle of the structure of morphine molecule, clarified the essential features of the strychnine formula, and investigated many other alkaloids, such as gnoscopine, harmaline, physostigmine, and rutaecarpine. His findings on details of alkaloid molecular structure of quinine helped in the synthesis of antimalarial drugs.

Robinson held honorary doctorates of numerous British and foreign universities and was awarded many medals. He was a fellow of the Royal Institute of Chemistry and of the Royal Society, President of the Chemical Society (1939-41) and elected president of the Royal Society in 1945.

He was a member of over thirty Government Committees and a delegate of the United Kingdom for the first conference of UNESCO in 1947. He was knighted in 1939.

Robinson was a keen mountaineer, and was also interested in music and photography.

Physiology or Medicine

For their discovery of the course of the catalytic conversion of glycogen.

Cori, Carl Ferdinand, b.—December 5, 1896, Prague, Czechoslovakia, d.—1984. Cori was educated at the gymnasium in Trieste, where his father was director of the Marine Biological Station, and the University of Prague Medical School. He graduated in 1920, the year he married Gerty Radnitz, a fellow student who was to become his collaborator until her death in 1957. The Coris moved to America in 1922, taking up an appointment at the New York State Institute for the Study of Malignant Diseases in Buffalo. In 1931 they both joined the Washington University Medical School, where Cori was successively professor of pharmacology and of biochemistry until his retirement in 1966. The great French physiologist Claude Bernard had shown as long as in 1850 that glucose is converted in the body into the complex carbohydrate glycogen. This is stored in the liver and muscle, ready to be converted back into glucose when the body needs further energy. Just what steps are involved in this process was the fundamental problem the Coris began to investigate in the mid-1930s.

CORI, CARL FERDINAND
Czechoslovakia/USA

The first clue came in 1935, when they discovered an unknown compound in minced frog muscle. This was glucose-1-phosphate, in which the phosphate molecule is joined to the glucose 6-carbon ring at the standard position (1). It was next established that when this new compound, or "Cori ester" as it was later called, was added to a frog or rabbit muscle extract, it was converted rapidly to glucose-6 phosphate by an enzyme that was named *phosphoglucomutase*, a process that was reversible. As only glucose itself can enter the cells of the body, glucose-6 phosphate must be converted to glucose by the enzyme phosphatase. Although the actual pathway of glycolysis is much more detailed and took several years to elucidate, the value of the Coris' work is undeniable. Above all they found the way to the crucial role of phosphates in the provision of cellular energy, the details of which were soon to be worked out by Fritz Lipmann. ◆

For their discovery of the course of the catalytic conversion of glycogen.

CORI, GERTY THERESA
Czechoslovakia/USA

Cori, Gerty Theresa, b.—August 15, 1896; Prague, d.—October 26, 1957, St. Louis, Missouri, USA. An American biochemist, Gerty graduated from the Medical School of Prague University in 1920, the year in which she married her lifelong collaborator Carl Cori. She moved with him to America, taking a post in 1922 at the New York State Institute for the Study of Malignant Diseases in Buffalo. In 1931 she went with her husband to the Washington University Medical School, where she became professor of biochemistry in 1947. ◆

For his discovery of the part played by the hormone of the anterior pituitary lobe in the metabolism of sugar.

Houssay, Bernardo Alberto, b.—April 10, 1887, Buenos Aires, d.—September 21, 1971, Buenos Aires. A physiologist who received (with Carl and Gerty Cori) the prize for his discovery of the role played by pituitary hormones in regulating the amount of blood sugar in animals.

Working with dogs that had been rendered diabetic by excision of the pancreas, he found that removal of the adenohyophysis greatly relieved the symptoms of the disease and made the animal unusually sensitive to insulin. He demonstrated that injection of pituitary extracts into normal animals induced diabetes by increasing the amount of sugar in the blood, indicating that the secretions of the gland oppose the action of insulin.

HOUSSAY, BERNARDO ALBERTO
Argentina

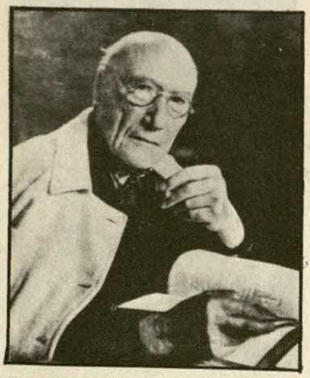
He was appointed professor of physiology (1910) and director of the Physiological Institute (1919) at the University of Buenos Aires. Houssay was one of 150 Argentinian educators dismissed from their posts by the military dictator General Juan Peron. Although he was reinstated in 1945, he was asked to submit his resignation a year later. He founded (1944) and has directed the Institute of Biology and Experimental Medicine, Buenos Aires, a leading physiological research centre in South America. His best known book is *Human Physiology* (1951). He took a bold stand against official tyranny during the presidency of Juan Peron. He refused lucrative chairs in the USA and started to live by doing clinical practice as he was deprived of his professorship and his state endowment for the Nobel award by the ruling military junta.

Note: The 1947 prize was awarded one-half jointly to Carl and Gerty Cori and other half to Houssay.

Literature

For his comprehensive and artistically significant writings, in which human problems and conditions have been presented with a fearless love of truth and keen psychological insight.

Gide, André Paul Guillaume, b.—November 22, 1869, Paris, d.—February 19, 1951, Paris. A French writer whose literary output reflected a lifelong analysis of personal and moral conflicts and relentlessly honest investigation of modern political and social situations.



GIDE, ANDRÉ PAUL GUILLAUME
France

Gide's first book *Les Cahiers d' Andre Walter* (anonymously, 1891), *La Traite du Narcisse* (The Treatise of Narcissus, 1891) with a subtitle "Theory of the Symbol", and *La Tentative Amourense* (The Attempt at Love, 1893) were ephemeral efforts. A little more virile were *La voyage d' Urien* (Travels of Urien, 1893), *Paludes* (Marshlands, 1895), *Saul* (1896) and *Promethee mal enchaine* (Prometherus Unchained, 1899). His love for his cousin Madelaine Rondeaux provided him with the themes for his short novels *L' Immoraliste* (1902, The Immoralist, 1930) and *La Symphonie pastorale* (1919, The Pastoral Symphony, 1934). The growing recognition of his suppressed homosexuality inspired *Les Nourritures terrestres* (1897, Fruits of the Earth, 1949). His longer fictions are *Les caves du Vatican* (1914, The Vatican Swindle, 1925), *Lafcadio's adventures* (1927), and *Les Faux-Monnayeurs* (1926, The Counterfeiters, 1927).

His autobiography is identifiable in *Corydon* (1923). The award to Gide was delayed by many years on moral grounds. Gide was a self-confessed homosexual.

Peace

THE FRIENDS SERVICE COUNCIL
(THE QUAKERS)
London

The Nobel Prize for Peace in 1947 was awarded to the Society of Friends (Friends Service Council, Great Britain, and American Friends' Service Committee, USA).

George Fox founded the sect in 1647. In the work of conciliation between nations and races no Christian community has made a contribution equal to that of the society. It has maintained its fundamental principles clearly and consistently to war and militarism and to work constructively for peace among the nations. The history of the quakers is well known, they were persecuted by the church authority of England and a number of them emigrated to America, where William Penn founded the colony of Pennsylvania in 1682. Due to their unobtrusive work the quakers have not always been given due recognition. Only two hundred thousand quakers are present all over the world, most of them live in Great Britain and USA. Their activities are considerable and is a result of their fundamental religious principle that, in everyman there is an "Inner light" (similar to Vedanta philosophy of Hinduism, *sic*). By virtue of this divine feeling they believe that one day man will be able to establish the Kingdom of God on earth. From the very beginning the quakers are pacifists and refuse to carry out military service. Their pacifist activity started in the time of the Crimean War and till today they are active in the propagation of peace.

1948

PHYSICS

Blackett, Lord Patrick Maynard Stuart

CHEMISTRY

Tiselius, Arne Wilhelm Kaurin

PHYSIOLOGY OR MEDICINE

Müller, Paul Hermann

LITERATURE

Eliot, Thomas Stearns

1948

Physics

For his development of the Wilson cloud chamber method, and his discoveries therewith in the fields of nuclear physics and cosmic radiation.

Blackett, Lord Patrick Maynard Stuart, b.—November 18, 1897, London, d.—July 13, 1974, London. The winner of the prize for discoveries in the field of cosmic radiation, which he accomplished primarily with cloud-chamber photographs which revealed the way in which a stable atomic nucleus can be disintegrated by bombarding it with alpha particles. Although such nuclear disintegration had been observed previously, his data clearly explained this phenomenon for the first time and was useful in explaining disintegration by other means.

BLACKETT, Lord PATRICK
MAYNARD STUART
Great Britain

After graduating from Cambridge University in 1921, he spent ten years as a research worker in the Cavendish Laboratory. There he began to improve the Wilson cloud chamber, a device which detects the path of ionizing particles into an automatic instrument for the study of cosmic radiation. He had taken over 20,000 photographs which contained over 400,000 alpha particle tracks. Of these only eight indicated the collision of alpha particle and a nitrogen molecule.

Blackett became Professor of Physics at the University of Manchester in 1937. In 1935, he showed that gamma rays, passing through lead-sheet, sometimes disappear giving rise to a positron and an electron. This clearly showed the conversion of energy into matter confirming the famous Einstein equation $E=mc^2$.

He established a school of cosmic-ray research and stimulated the development of other research interests, which led to the creation of the first Professorship in Radio Astronomy at the University of Manchester, and to the building of the Jodrell Bank Experimental Station for Radio Astronomy. In 1953, he was appointed professor and head of the physics department of the Imperial College of Science and Technology in London, where he became senior research fellow in 1965. He was elected president of Royal Society in 1965. He was created a life peer in 1969.

Chemistry

For his research on electrophoresis and adsorption analysis, especially for his discoveries concerning the complex nature of the serum proteins.

Tiselius, Arne Wilhelm Kaurin, b.—August 10, 1902, Stockholm, d.—October 29, 1917, Uppsala, Sweden. Tiselius studied chemistry, physics and mathematics at the University of Uppsala, and did his graduate studies at the same university and submitted his Ph.D. thesis in 1930. He was appointed Assistant Professor in Physical Chemistry (1930-37) and subsequently Professor in Biochemistry (1937-67). In 1946, he became head of a new Institute of Biochemistry in Uppsala which had become a very active centre for developing new separation techniques in biochemistry.

TISELIUS, ARNE WILHELM KAURIN
Sweden

Tiselius started his studies on certain aspects of ultra centrifugation under the guidance of Svedberg, but soon changed to electrophoresis of proteins. His thesis was a thorough study of the behaviour of proteins in an electric field in the so-called U-tube which he invented. He demonstrated that biological "colloids" like proteins were composed of different kinds of discrete macro-molecules that were homogeneous in the same sense as ordinary low molecular weight compounds. This confirmed Svedberg's findings with the "ultracentrifuge" Tiselius constructed an electrophoresis cell with a rectangular cross-section. This was an improvization over the earlier one which had a circular cross-section. This helped in increasing the sensitivity of the optical detection system and the efficient dissipation of Joule heat generated. The experiments were carried out at a temperature of 0-4°C, at which the solutions used had their maximum density. These improvizations eliminated convective disturbances to a great extent and made electrophoresis an exact and powerful tool in biochemistry. With the help of these improvizations Tiselius and co-workers showed that blood serum contains at least four classes of proteins, albumin, alpha-, beta- and gamma-globulin respectively.

Tiselius did remarkable work on the phenomenon of adsorption, particularly by the application of chromatography to proteins. General techniques of chromatography like elution gradient and displacement chromatography were developed by him. Calcium phosphate as a non-denaturing absorbent for protein chromatography was introduced by him.

Tiselius was a very important link in the communication between science and government in Sweden, and played a very active role in Swedish society after World War II. He started the Swedish Natural Science Research Council of which he was Chairman and a government advisory committee on general research policy. Tiselius became the Vice-President of the Nobel Foundation in 1947. He also worked on various international scientific organisations. He was President (1951-55) of International Union of Pure and Applied Chemistry and one of the founders of European Molecular Biology Organization. In 1957 he was elected a Foreign Fellow of the Royal Society. He also took an active part in the Pugwash movement.

Physiology or Medicine

For his discovery of the high efficiency of DDT as a contact poison against several arthropods.

Müller, Paul Hermann, b.—January 12, 1899, Olten, Switzerland, d.—October 12, 1965, Basel. A chemist who received the prize for discovering the potent toxic effects on insects of DDT, the most widely used insecticide. Müller began his career with investigations of dyes and tanning materials. In 1935 he began his search for an "ideal" insecticide, one that would show rapid, potent toxicity for the greatest possible number of insect species, but would cause very little or no damage to plants and warm-blooded animals. He also required that it should be a substance possessing a high degree of chemical stability, so that its effect would persist for long periods of time and that its manufacture be economical. Four years later, after exhaustive investigations, Müller synthesized and tested a substance known as *dichlorodiphenyltrichloroethane* (DDT) and found that it satisfied the requirements he had originally sought for. The German chemist Othmar Zeidler had first synthesized the compound in 1874, but had failed to realize its value as an insecticide.

MÜLLER, PAUL HERMANN
Switzerland

In 1939, DDT was tested successfully against the Colorado potato-beetle by the Swiss government, and by the US Department of Agriculture in 1943. In January 1944, DDT was used to quash an outbreak of typhus carried by lice in Naples, the first time a winter typhus epidemic could be stopped.

Although Müller had required his ideal insecticide to be relatively nontoxic to warm-blooded animals, the widespread use and persistence of DDT has made it a hazard to animal life, and it has shown signs of disrupting ecological balance. The use of DDT has been banned in many countries.

Literature

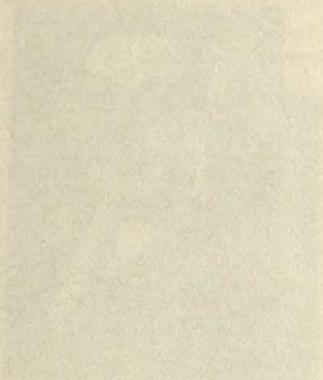
For his outstanding, pioneer contribution to present-day poetry.

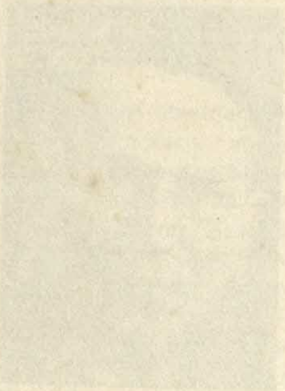
Eliot, Thomas Stearns, b.—September 26, 1888, St Louis, Missouri, d.—January 4, 1965, London. A poet, playwright and critic, a leader of the modernist movement in poetry, whose intellectual superiority made him the literary doyen of his age. His recognition came with the publication of *The Waste Land* in 1922.

ELIOT, THOMAS STEARNS
USA/Great Britain

Eliot was reared in St. Louis but his family background and education had more of a New England influence. He initially studied at Harvard and then in Europe and worked briefly in London as a teacher and a bank clerk. He started his career as a critic. His first book *Prufrock and Other Observations* (1917) is probably the first book of mature modern poetry in English language. He next wrote *Poems* (1919) and then *The Waste Land* (1922). In 1927 he acquired British nationality and converted to the Anglican faith and wrote *Ash Wednesday* (1930). In 1935, he wrote *Four Quartets*. Of his seven plays the *Murder in the Cathedral* (1935) is based on the death of Samuel Beckett, archbishop of Canterbury. He wrote many books of criticism like *The Sacred Wood* (1920) and *To Criticize the Critic* (1965) and edited a quarterly critical review called *The Criterion*.

He was one of the chiefs of Faber and Faber Publishing Co. In addition to the honorary degrees awarded by Harvard and other American universities, Eliot received such honours from Oxford, Munich, and Aix-en-Provence. In 1948, he was made a Knight Commander of the Order of Merit by King George VI. The President of France decorated him with the ribbon of the Legion of Honor.





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1949

PHYSICS
Yukawa, Hideki

CHEMISTRY
Giauque, William Francis

PHYSIOLOGY OR MEDICINE
Hess, Walter Rudolf
Moniz, Antonio Caetano de Abreu Freire Egas

LITERATURE
Faulkner, William

PEACE
Boyd Orr of Brechin, Lord John

1949

Physics

For his prediction of the existence of mesons on the basis of theoretical work on nuclear forces.

Yukawa, Hideki, b.—January 23, 1907, Tokyo, d.—September 10, 1981, Kyoto. A Japanese physicist who graduated from the Kyoto University in 1926 with honours in physics. He took his M.Sc. in 1929. He was initially a lecturer in physics at the Kyoto University in 1932, later he joined the faculty of the Osaka University as an assistant professor in 1933, and became a full professor in 1936. In 1938, he was admitted to the Degree of Doctor of Science. He made extensive researches on particle physics and the "Meson" theory and its developments. In 1936 Yukawa predicted that a nucleus could absorb one of the K Shell electrons and that this would be equivalent to emitting a positron. This prediction was verified in 1938.

YUKAWA, HIDEKI
Japan

After World War II he was invited to the Institute of Advanced Studies at Princeton, and Columbia University, USA, for working on similar lines. In 1953 he returned to Kyoto University. He had signed a declaration in 1955 alongwith Lord Russel and Einstein that avoiding the destruction of mankind comes before anything. *He was the first Japanese to receive a Nobel Prize.*

Chemistry

For his contributions in the field of chemical thermodynamics, particularly concerning the behaviour of substances at extremely low temperatures.

Giauque, William Francis, b.—May 12, 1895, Niagra Falls, Ontario, Canada. He was educated in Public Grammar School in Michigan, and completed his secondary school education in the Niagra Falls Collegiate Institute. After graduation, owing to poor financial condition at home, he took up employment in the laboratory of the Hooker Electro-Chemical Company in Niagra Falls, New York. He was highly impressed with the organization and functioning of the chemical plant, and soon decided to become a chemical engineer.

GIAUQUE, WILLIAM FRANCIS
USA

After two years, Giauque joined theCollege of Chemistry of the University of California. He took his B.Sc. degree with highest honours in 1920, and obtained his Ph.D. in chemistry in 1922. The same year he was appointed Instructor, and later became Professor of Chemistry.

Giauque married in 1932 and has two sons.

Giauque's work has fully proved the third law of thermodynamics. As a result of his work, it is now possible to calculate the difference in entropy, and also the entropy for a large number of elements and chemical compounds. He worked out new experimental methods, significant among those being the magnetic cooling method, which has made it possible to reach temperatures close to absolute zero.

Giauque worked out practical methods for calculating the thermodynamic constants, by comparing the entropy values he obtained by calorimetric entropy with the values he could calculate from the band spectra (spectroscopic entropy) which has given rise to new discoveries. During the course of his spectroscopic experiments, he made the remarkable discovery in 1929 that the element of oxygen does not only consist of atoms with atomic weight 16 but contains in addition small quantities of oxygen isotopes with atomic weights 17 and 18. This discovery is of special significance since the atomic weight of oxygen is the basis for the calculations of the atomic weights of all the other elements.

Giauque has published about 75 scientific papers. He has received the Chandler Medal from Columbia University, the Elliot Cresson Medal from the Franklin Institute, the Willard Gibbs Medal (1951) and the Gilbert Newton Lewis Medal (1956).

He holds honorary degrees from Columbia and California Universities. He is a fellow of the American Physical Society and the American Academy of Arts and Sciences.

Physiology or Medicine

For his discovery of the functional organization of the interbrain as a coordination of the activities of the internal organs.

Hess, Walter Rudolf, b.—March 17, 1881, Frauenfeld, Switzerland, d.—August 12, 1973, Locarno. A physiologist who received with Antonio Egas Moniz the prize for discovering the role played by certain parts of the brain in determining and coordinating the functions of internal organs.

HESS, WALTER RUDOLF
Switzerland

He was originally an ophthalmologist, but turned to the study of physiology at the University of Bonn and was appointed professor of physiology and director of the Physiological Institute (1917-51) at the University of Zuerich, where he became interested in the study of the autonomic nervous system. Using fine electrodes to stimulate or destroy specific areas of the brain in cats and dogs, he found that the seat of autonomic function lies at the base of the brain, in the medulla oblongata and the diencephalon, particularly that part of the brain known as the hypothalamus. He mapped the control centres for each function to such a degree that he could induce the physical behaviour pattern of a cat confronted by a dog simply by stimulating the proper points on the animal's hypothalamus.

Among Hess's books, *The Biology of Mind* (1964) is very well known.

◆

For his discovery of the therapeutic value of leucotomy in certain psychoses.

Moniz, Antonio Caetano de Abreu Freire Egas, b.—November 29, 1874, Avanca, Portugal; d.—December 13, 1955, Lisbon. A neurologist, statesman and founder of psychosurgery. He received with Walter Rudolf Hess the prize for the development of prefrontal leucotomy (lobotomy) as a radical therapy for certain types of psychoses.

As the first professor of neurology at the University of Lisbon, he introduced and developed (1927-37) cerebral angiography, a method of visualizing the blood vessels of the brain by injecting into the carotid artery substances that are opaque to X-ray. This technique has proved to be of immense value in the diagnosis of intracranial diseases such as tumours and vascular disorders.

MONIZ, ANTONIO CAETANO DE ABREU
FREIRE EGAS
Portugal

Realizing that certain psychoses, particularly schizophrenia and paranoia, involve recurrent, pathological thought patterns that alter normal psychological processes, Moniz reasoned that severing the nerve fibres between the apex of the frontal lobes, known to be closely associated with psychological responses, and the thalamus might cause a transformation of psychotic thought patterns into normal ones. In 1936, he and his associate, Almeida Lima, a neurosurgeon, performed the operation known as "Prefrontal leucotomy", the first type of human brain surgery for the treatment of psychological disorders. The operation, though successful in eliminating certain intractable psychoses, is known to produce side effects, and he cautioned that it was such a radical procedure that it is to be followed only after all other treatments have failed.

Moniz was also politically active. He served several times between 1903 and 1917 as the Portuguese minister at Madrid (1917-18) and led the Portuguese delegation to the Paris Conference (1918-19).

Note: The 1949 prize was awarded jointly to Hess and Moniz.

Literature

For his powerful and artistically unique contribution to the modern American novel.

Faulkner, William, b.—September 25, 1897, New Albany, Mississippi, d.—July 6, 1961, Oxford, Mississippi. A novelist whose imaginative work, a series known as the *Yoknapatawpha cycle*, developed as a fable of human destinies in the Southern part of the USA. He did not like schooling and his formal education ended after the second year in a high school. He enrolled as a special student at the University of Mississippi. In the summer of 1918, he joined the Royal Canadian Air Force as a cadet pilot but the war ended before his commissioning. He returned to Oxford, Mississippi and worked at odd jobs like a clerk in a New York bookshop and a post master at the University of Mississippi before establishing himself as a writer.

FAULKNER, WILLIAM
USA

His first book, a book of poems named *The Marble Faun* was published in 1924, and his first novel *Soldier's Pay*, in 1926. By 1927, he had completed writing his third novel *Sartoris* and published it in 1929. He wrote an experimental novel called *The Sound and the Fury* in 1929. During the later part of the same year he wrote his tour de force, *As I Lay Dying* and got it published in 1930.

His only play the *Requiem for a Nun* was published in 1951. He was distinguished not only as a novelist and short-story writer but also as a writer of film scripts for American motion pictures made in Hollywood.

Peace

BOYD ORR OF BRECHIN, Lord JOHN
Great Britain

Boyd Orr of Brechin, Lord John, b.—September 23, 1880, Kilmaurs, Ayrshire, d.—June 25, 1971, Edzell, Angus. A scientist and an authority on nutrition. He was educated at the University of Glasgow, where he enrolled as a theological student before turning to the study of nutrition. In 1914, he became director of the Institute of Animal Nutrition at the University of Aberdeen and in 1929 founded the Imperial Bureau of Animal Nutrition there. He first gained fame with the publication of *Food, Health and Income*, a report of a dietary survey by income groups made during 1935 that showed that the cost of a diet fulfilling basic nutritional requirements was beyond the means of half the British people and that 10 per cent of the population was undernourished. This and other reports conducted by the Rowett Research Institute formed the basis of the British food-rationing system in World War II.

During the war, Boyd Orr was a member of the Cabinet's scientific committee on food policy and held the chair of agriculture at Aberdeen University. In 1945, he became rector of the University of Glasgow, a member of Parliament for the Scottish Universities, and director general of the United Nations Food and Agriculture Organization (FAO), where he served until 1948. He was knighted in 1935 and became a baron in 1949. His writings include *The National Food Supply and Its Influence on Public Health* (1934), *Food and People* (1943), *Food the Foundation of World Unity* (1948), and *The White Man's Dilemma* (1963).

1950

PHYSICS
Powell, Cecil Frank

CHEMISTRY
Alder, Kurt / Diels, Otto Paul Hermann

PHYSIOLOGY OR MEDICINE
Hench, Philip Showalter
Kendall, Edward Calvin
Reichstein, Tadeus

LITERATURE
Russell, Bertrand

PEACE
Bunche, Ralph

1950

Physics

For his development of the photographic method of studying nuclear processes and his discoveries regarding mesons made with this method.

Powell, Cecil Frank, b.—December 5, 1903, Tonbridge, Kent, England, d.—August 9, 1969, near Milan, Italy. Powell's father and paternal grandfather were gunsmiths and his mother was the daughter of a schoolmaster. His knowledge and interest in nature, especially the countryside and its flora, was influenced by his boyhood experiences. His parents were determined that their children should be educated to have a better life. Powell won a scholarship to Judd school, Tonbridge after elementary school. Here he was guided and greatly influenced by his physics teacher who among other things introduced him to the use of homemade crystal in the reception of wireless signals. In 1921, he won a scholarship to Sidney Sussex College, Cambridge, and graduated with first class honours in science in 1935. He was selected as a research student by the Nobel Laureate Ernest Rutherford (Chemistry 1908) to work under C.T.R. Wilson, the inventor of the cloud chamber on the photographs of the droplets formed during the trajectory of the charged particles. During the course of his experiments he showed that supersaturation in the rapidly expanding steam explained the anomalous discharge rate of steam through nozzles which was higher than was theoretically possible. His findings contributed to the improvement of the steam turbine. After obtaining his Ph.D. from Cambridge in 1928, Powell became a research assistant to A.M. Tyndall, Director of the Henry Herbert Wills Physical Laboratory in the University of Bristol. He remained here for the rest of his career becoming Professor of Physics in 1948 and Director in 1964.

In the Bristol Physical Laboratory he worked on the calculation of precise values for the mobility of ions in gases. With increased interest in nuclear physics, laboratories all over the world began building facilities for experimental work. At the Bristol Laboratory, Powell began to construct a Cockcroft-Walton generator for the acceleration of proton. The aim was to use the proton beam to disintegrate light elements and to study the resulting scattering of neutron in a hydrogen filled cloud chamber. As the work progressed, in 1938, Powell became concerned with a technique of detecting high energy particles by the changes they produced on a photographic emulsion through which they move, the method being first introduced by Austrian physicist W. Hitler. He prepared a package of small photographic plates which were taken to Jungfraujoch and subjected to high-altitude cosmic rays. Processed months later at Bristol Laboratory, the plates showed tracks giving clear indication of nuclear disintegration due to collision of high energy particles with nuclei in the emulsion. Although Powell was

POWELL, CECIL FRANK
Great Britain

unaware of it, earlier workers had rejected this technique as not precise enough for work in nuclear physics. In 1945, G.P.S. Occhialini joined Powell's group and persuaded Ilford Ltd., leading manufacturers of photographic material, to make efforts to improve recording properties of emulsions. The new emulsion exposed in the Pyrenees and developed in Bristol showed a wealth of clearly visible nuclear disintegrations caused by fast and high energy cosmic ray particles.

The group set the trend in employing scanning teams consisting of observers using microscopes who systematically searched for tracks of disintegration. Methods were also devised to measure the mass, charge, energy and velocity of the particles produced. In 1947, the group finally struck dirt. They identified a new particle in the cosmic radiation in the many tracks recorded on improved photographic plates. Powell, Occhialini and C.H.G. Lattes discovered the pi-meson (pion) and demonstrated that the sub-nuclear particle was produced directly in nuclear reactions but rapidly decayed in flight, producing the mu-meson (muon). Although the prediction of Hideki Yukawa (Japanese Nobel Laureate of 1949) that there existed a particle "meson" which has a mass 200 times greater than the electron, had been partially proved by the discovery of a new particle by American nuclear physicists, their particle did not strongly interact with the nuclei. Powell's group showed that there were in fact two mesons—the pi-meson or pion and the other theoretically predicted meson called a mu-meson or muon which keeps the nucleus together. This discovery opened a new era of particle physics. Powell and his group continued to work on the application and development of the photographic method and his laboratory at Bristol became a source of discoveries in meson physics. In the 1950s he devised a system of sending photographic plates on high altitude balloons to record the cosmic ray interactions in the stratosphere. This system was later to become an international collaboration involving institutions in almost every European nation.

Powell played a key role in the establishment of the European Centre for Nuclear Research and was on its Scientific Policy Committee. He took active interest in the World Federation of Scientific Workers and was its President from 1959 until his death. He was a founder of the Pugwash Conferences on Science and World Affairs and was Deputy Chairman of its Continuing Committee until 1967, when he became Chairman. He was convinced of the social responsibility of scientists and much of his time in the 1950s and 1960s was devoted to these scientific bodies. In his articles he expressed his deep concern over the perils of destructive weapons and stressed the need for international cooperation and world peace.

Chemistry

For their discovery and development of the diene synthesis.

Alder, Kurt, b.—July 10, 1902, Koenigshuette, Upper Silesia, d.—June 2, 1958, Cologne. Alder spent his young years in industrial surroundings, and was forced to leave his home after the World War I. He studied chemistry at Berlin University in 1922, and later in Kiel wherefrom he obtained his Ph.D.

ALDER, KURT
Germany

He was appointed Reader in Chemistry at the Kiel University in 1930, and promoted as lecturer in 1934. He became Head of the Department in the science laboratories of the I.G. Farben Industrie at Leverkushen in 1936. There he worked on the preparation and constitution of synthetic rubber.

He became Professor of Experimental Chemistry and Chemical Technology at Cologne University in 1940, and later became the Director of the Institute of Chemistry.

He was pupil of Otto Diels and acted as his assistant after obtaining his Doctorate. The association with Diels made him familiar with the synthesis of 'Dienes'.

Dienes are chemical compounds with two double bonds. Diene synthesis occurs between two different molecules of more or less complex structure. The diene contains a chain of four carbon atoms linked by two double bonds and in the centre of the chain there is a single bond.

Alder and Diels gave the first experimental proof of the nature of the reaction and demonstrated its compounds. They developed a general method of synthesis of great fundamental significance, by means of which a large number of compounds of complex structure can easily be produced, compounds which are quite impossible or very difficult to be produced in any other way e.g., camphor molecule with its peculiar carbon framework. Work on the constitution of complex natural products like cantharidin, active substance of the 'spanish fly', could be successfully done with the help of this method. His method proved a fruitful aid in the synthesis of ergosterol and vitamin D.

Alder also worked on extensive stereochemical investigations, prompted by selection phenomena during organic chemical reactions, particularly in unsaturated systems. He investigated the behaviour of double bonds in stressed carbon rings and the phenomena of intermolecular rearrangements.

The work of Alder in association with Diels is immortalised by the "Diels-Alder reaction" which they formulated.

In recognition of his contribution to chemistry, Alder was awarded the Nobel Prize for chemistry in 1950, jointly with his teacher Otto Diels.

Alder and Diels wrote their first paper on the reaction of dienes with quinones in 1928. Alder's investigations has been described in about 150 papers.

He received the Emil Fischer Memorial Medal from the Association of German Chemists in 1938. He became a member of the German Academy of Natural Philosophers in Halle in the same year. He received the honorary degree of M.D. from the Medical faculty of the University of Cologne in 1950, and the honorary doctorate of the University of Salamanca in 1954. ◆

For their discovery and development of the diene synthesis.

Diels, Otto Paul Hermann, b.—January 23, 1876, Hamburg, d.—March 7, 1954, Kiel. Diels was the son of the great classical scholar Herman Diels (1842-1922). He studied chemistry in the University of Berlin under Emil Fischer (Nobel Laureate), becoming Titular Professor in 1906. In 1916, he was appointed Professor of Chemistry in the University of Kiel, which he retained until his retirement in 1948. During World War II, two of his sons were killed on the Eastern Front, and his home and his department were destroyed in air attacks. He remained in office through a period of great difficulty, even though he wished to retire in 1945, and began the rebuilding of the University.

DIELS, OTTO PAUL HERMANN
Germany

Diels in 1906 discovered a highly reactive substance called malonic anhydride or carbon suboxide and determined its chemical composition and properties. He obtained carbon suboxide by removing the elements of water from malonic acid. His work in the field of sterol chemistry contributed to a better understanding of the field, and made important advances by his method of selenium dehydrogenation. This drastic process converted sterols into aromatic hydrocarbons. His work on the structure of "Diels" hydrocarbon (an aromatic hydrocarbon) helped in the identification of the sterol skeleton. His work with his assistant Kurt Alder in 1928, on the reactions of azo-dicarboxylic ester, led to the discovery of the "Diels-Alder reaction". This reaction is the addition of a conjugated drive to a large class of unsaturated compounds, dienophiles, to give a six-membered ring compound. Dienes are organic compounds with two carbon to carbon double bonds, and are used in the synthesis of various organic compounds. Their work has become specially important in the production of synthetic rubber and plastics, and in the petrochemical industry.

Note: The prize for 1950 was awarded jointly to Diels and Alder.

Physiology or Medicine

For their discoveries relating to the hormones of the adrenal cortex, their structure and biological effects.

Hench, Philip Showalter, b.—February 28, 1896, Pittsburgh, Pennsylvania, d.—March 30, 1965, Ocho Rios, Jamaica. A physician who with Edward C. Kendall in 1948 successfully applied an adrenal hormone (later known as cortisone) clinically in the treatment of rheumatoid arthritis. With Tadeus Reichstein of Switzerland, Hench and Kendall were awarded the prize for their discoveries concerning hormones of the adrenal cortex, their structure and biological effects.

HENCH, PHILIP SHOWALTER
USA

He was a graduate in medicine (1920) of the University of Pittsburgh. He became a fellow in medicine at the Mayo Clinic, Rochester, Minnesota, later he was a staff member. In 1926 he became a consultant in the division of medicine and head of the section on rheumatic diseases. He noticed that during pregnancy and in the presence of jaundice the severe pain of arthritis may decrease and even disappear. In search of the antiarthritic substance he and Kendall studied endocrinological factors in rheumatic diseases. This work led to their use of cortisone and of ACTH (adrenocorticotropic hormone) a hormone of the pituitary gland used in alleviation of rheumatoid arthritis.

◆

For their discoveries relating to the hormones of the adrenal cortex, their structure and biological effects.

Kendall, Edward Calvin, b.—March 8, 1886, South Norwalk, Connecticut; d.—May 4, 1972, Princeton, New Jersey. A chemist who isolated from the adrenal cortex the steroid hormone cortisone and with Philip S. Hench successfully applied the hormone in the treatment of rheumatoid arthritis. With Hench and Tadeus Reichstein of Switzerland he received the prize for additional discoveries concerning hormones of the adrenal cortex (corticosterone and cortisol), their structures, and their biological effects.

KENDALL, EDWARD CALVIN
USA

Before his work on cortisone, Kendall isolated the active constituent thyroxine of the thyroid hormone and crystallized and established the chemical nature of glutathione, a compound important in biological oxidation-reduction reactions.

He was a graduate of Columbia University (Ph.D. 1910). Kendall joined the staff of the Mayo Foundation, Rochester, Minnesota, in 1914 and remained head of its biochemistry division until his retirement in 1951; from 1945 he also acted as head of the biochemistry laboratory. He was later a visiting professor of chemistry at Princeton University. ◇

For their discoveries relating to the hormones of the adrenal cortex, their structure and biological effects.

Reichstein, Tadeus, b.—July 20,. 1897, Wloclawek, Poland. He first went to a private tutor and later to the *Oberrealschule* (technical school of junior college grade) and the *Eidgenossische Technische Hochschule* (State Technical College).

REICHSTEIN, TADEUS
Switzerland

In 1916, Reichstein passed his school-leaving examination and began to study chemistry at the above-mentioned college at Zuerich, taking his diploma in 1920. He then spent a year in industry and then began to work for his doctorate under Professor H. Staudinger (Nobel Laureate). In 1922, he graduated and then began research under Staudinger on the composition of the flavouring substances in roasted coffee.

In 1929, he qualified as a lecturer at the college. Here he lectured on organic and physiological chemistry and in 1931, when his work on aromatic substances in coffee and chicory ended, he became assistant to Professor L. Ruzicka (Nobel Laureate) and was then able to devote himself exclusively to scientific research.

Reichstein also collaborated with F.C. Kendall and P.S. Hench in their work on the hormones of the adrenal cortex which culminated in the isolation of cortisone and the discovery of the therapeutic value in the treatment of rheumatoid arthritis.

Note: **Reichstein, Kendall and Hench were jointly awarded the 1950 prize.**

Literature

In recognition of his varied and significant writings, in which he champions humanitarian ideals and freedom of thought.

Russell, Bertrand, b.—May 18, 1872, Ravenscroft, Monmouthshire, Merioneth, Wales, d.—February 2, 1970, Trelleck. A logician, and one of the most outstanding philosophers of the 20th century. He was noted for his work in mathematical logic.

RUSSELL, BERTRAND
Great Britain

He was orphaned very early in age and grew up in the home of his grandfather, Lord John Russell, whose peerage he later inherited. He was first educated at home and then sent to Cambridge in 1890, where he studied mathematics and philosophy and graduated in 1894. During his long chequered career he published a vast number of books on logic, theory of knowledge, and many other topics. His best known work is the logical treatise *Principia Mathematica* (1910-13, with Alfred North Whitehead). Some of his other books are: *The Problems of Philosophy* (1912), *Principles of Social Reconstruction* (1916), *Mysticism and Logic* (1918), *Road to Freedom* (1918), *An Introduction to Mathematical Philosophy* (1919), *The Scientific Outlook* (1931), *Sceptical Essays* (1948), *Human Knowledge: Its Scope and Limits* (1948), *Authority and the Individual* (1949), *Unpopular Essays* (1950), and *Human Society in Ethics and Politics* (1954).

He was twice imprisoned for activities associated with his strong advocacy of pacifism and for civil disobedience to deter the proliferation of conventional arms and nuclear armaments, in 1918 and 1961 respectively.

Peace

Bunche, Ralph, b.—August 7, 1904, Detroit, d.—December 9, 1971, New York City. A founder and key diplomat of the United Nations for more than two decades and winner of the prize for his successful negotiation of an Arab-Israeli truce in Palestine in 1940. He is the first coloured man in the world to be so honoured.

Earning graduate degrees in government and international relations at Harvard University, he joined the faculty of Howard University where he set up a department of political science of which he was made a full professor in 1938. Meanwhile, he travelled through French West Africa on a Rosenwald field fellowship, studying and comparing the administration of French Togoland, a mandated area, and Dahomey, a colony. He later did post-doctoral research at Northwestern University, Illinois, and the London School of Economics before returning to Africa for further studies in colonial policy. Between 1938 and 1940 he collaborated with Gunnar Myrdal, (later Nobel Laureate in economic sciences), the Swedish sociologist, in the monumental study of US race relations which was published as *An American Dilemma* in 1944.

BUNCHE, RALPH
USA

During World War II Bunche served in the US War Department as an African and Far Eastern analyst. After working at the office of Strategic Services, he moved in 1944 to the State Department , where he headed the Division of Independent Area Affairs, specializing in colonial problems. He was active in the preliminary planning for the United Nations and the San Francisco Conference of 1945. He drew up the trusteeship sections of the United Nations Charter. Two years later he joined the permanent UN Secretariat in New York as director of the New Trusteeship Department that established guidelines by which a number of territories were enabled to reach statehood.

Asked a few years later by Secretary General Trygve Lie to aid a UN special committee appointed to negotiate a settlement between warring Palestinian Arabs and Jews, he was put unexpectedly into the principal role when the chief mediator Count Bernadotte was assassinated. Throughout the period that followed, Bunche worked tirelessly to end the fighting, finally negotiating armistices between February and May 1949.

Elevated in 1950 to the post of under secretary and two years later to under secretary for special politial affairs, Bunche became chief troubleshooter for the new UN Secretary General, Dag Hammarskjold. In 1956 he supervised the deployment of an UN neutral force in the area of the Suez Canal following the invasion of that area by British, French and Israeli troops. In 1960, he again found himself in charge of UN peacekeeping machinery in Congo. He was mostly responsible for preventing the collapse of Congo after the province of Katanga had seceded. Finally, in 1964 he went to Cyprus to direct the neutral troops that intervened between hostile Greek Cypriots and the Turks. In all these endeavours he viewed the use of the military force as only a temporary expedient until peaceful solutions could be reached. He received innumerable degrees and honours, including the US Medal of Freedom, the highest civilian award granted by USA.

Attracting some criticism for seeming to neglect the black freedom movement at home, Bunche began to speak out more directly on US racial discrimination. In addition, though not in the best of health, he participated in the 1965 civil rights marches in both Selma and Montgomery, Alabama and also served as a board member for the National Association for the Advancement of Coloured People.

At the time of his resignation from the UN for reasons of failing health, he was the most influential political advisor to the later Secretary General, U Thant and the highest ranking American in United Nations.

1951

PHYSICS

Cockcroft, Sir John Douglas
Walton, Ernest Thomas Sinton

CHEMISTRY

McMillan, Edwin Mattison
Seaborg, Glenn Theodore

PHYSIOLOGY OR MEDICINE

Theiler, Max

LITERATURE

Lagerkvist, Pär Fabian

PEACE

Jouhaux, Léon

1951

Physics

For their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles.

Cockcroft, Sir John Douglas, b.—May 27, 1897, Todmorden, Yorkshire, d.—September 18, 1967, Cambridge. Cockcroft came of a cotton manufacturing family. He was educated in Tolmorden in the local secondary school. In 1914 he entered Manchester University to read mathematics, one of his lecturers here was the Nobel Laureate Ernest Rutherford. The following year he left to join the Royal Field Artillery and he was one of the few who served unscathed through almost all the great later battles. After the war, he was apprenticed to the engineering firm of Metropolitan Vickers who sent him for training as electrical engineer at the College of Technology, Manchester. His remarkable ability in science eventually made him study Mathematics at Cambridge University, taking the Mathematical Tripos in 1924.

Cockcroft joined the staff of the Cavendish Laboratory in 1922. He thus joined the illustrious team of researchers brought together to work under Rutherford. His engineering and mathematical background provided valuable practical expertise.

Cockcroft and Walton (Nobel Laureate). started work on their proton accelerator in 1929. A particle accelerator speeds up atomic particles to very high velocities in order to increase their energy. An electrical field of very high voltage created across the path of the particles causes an increase in their velocity. By 1932 Cockcroft and Walton had their own proton accelerator ready to be tested. Theirs was the first example of man-made nuclear transformation—the energization of each atom of lithium, their target metal to form two atoms of helium by the hydrogen ion (protons) flowing through a vacuum tube whose speed was boosted up to a point where the voltage was very high.

COCKCROFT, Sir JOHN DOUGLAS
Great Britain

The Cockcroft-Walton accelerator proved to be one of the most useful in nuclear physics laboratories. They conducted further research on the splitting of other atoms and established importance of accelerators as a tool for nuclear research. These accelerators have also found direct applications in industry, such as detecting flaws in metal casing, and in medicine for the treatment of cancer.

Cockcroft also played a leading role in the development of radar for defence purposes. He was a member of the Tizard Mission to the United States in 1940. During the war in 1941 he became Chief Superintendent of the Air Defence Research and Development Establishment and in 1944 became the Director of the Atomic Energy Division, National Research Council of Canada. He proved to be an outstanding scientific administrator. When war ended he was the natural choice as head of Britain's first atomic energy research laboratory at Harwell, and was a chairman in the Ministry of Defence. Cockcroft was knighted in 1948, and conferred Knight Commander of the Bath in 1953. In 1960 he became Master of the newly founded Churchill College at Cambridge and he was still Master at the time of his sudden death at the age of 70.

Cockcroft was elected Fellow of the Royal Society in 1936. A number of universities bestowed honorary degrees on him. He was Chancellor (1961-65) of the Australian National University, Canberra. He became the President of the British Association for the Advancement of Science in 1967. In 1957 he was awarded the outstanding distinction of admission to the Order of Merit. He received the Atoms for Peace award in 1961. ◇

For their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles.

Walton, Ernest Thomas Sinton, b.—October 6, 1903, Dungorvan, Waterford country, Ireland. A joint winner with Sir John Douglas Cockcroft of England of the prize for the development of the first nuclear particle accelerator, known as the "Cockcroft-Walton generator". The advent of the above device for accelerating subatomic particles advanced the study of nuclear structure and set the course for the development of nuclear physics. In 1927, Walton went to Trinity College, Cambridge, where he worked with Cockcroft in the Cavendish Laboratory under Lord Ernest Rutherford. The next year he attempted two methods of particle acceleration that were later developed and used in the betatron and the linear accelerator. Both attempts were fruitless because the necessary equipment was not available, and almost nothing was known about the required techniques. Then in 1929, Cockcroft and Walton devised their accelerator and in 1931 distintegrated lithium nuclei with protons, the first artificial nuclear reaction not utilizing radioactive substances.

WALTON, ERNEST THOMAS SINTON
Ireland

In 1947, Walton became professor of natural and experimental philosophy at Trinity College, University of Dublin. In 1952, he was made a chairman of the School of Cosmic Physics, Dublin Institute for Advanced Studies, and in 1960 a senior fellow.

Note: The 1951 prize was awarded jointly to Walton and Cockcroft.

Chemistry

For their discoveries in the chemistry of the trans-uranium elements.

McMillan, Edwin Mattison, b.—September 18, 1907, Redonda Beach, California. McMillan had his early education in Pasadena, California. He received his B.Sc. degree in 1928 from the California Institute of Technology, and M.Sc. degree the next year. In 1932, he obtained his Ph.D. from Princeton University. He became a National Research Fellow in the University of California

McMILLAN, EDWIN MATTISON
USA

at Berkeley the same year. He became Instructor in the Radiation Laboratory in 1935, Assistant Professor in 1936, Associate Professor in 1941 and Professor in 1946.

McMillan is married to Elsie Walford Blumer; they have one daughter.

The first transuranium element was produced by McMillan and Abelson in 1940 at the University of California which they called neptunium after the planet Neptune. McMillan and Seaborg reported in the same year the finding of yet another element, which they named plutonium after the planet Pluto.

McMillan shared the Atoms for Peace Award of 1963 with Professor V.I. Veksler. He is a fellow of the American Physical Society and the American Academy of Arts and Sciences, a member of the National Academy of Sciences and the American Philosophical Society. He served on the General Advisory Committee to the Atomic Energy Commission during 1954-58 and, in 1960, he was appointed to the Commission on High Energy Physics of the International Union of Pure and Applied Physics. He holds honorary doctorates from many academic bodies for his outstanding contribution to science.

◆

For their discoveries in the chemistry of the transuranium elements.

Seaborg, Glenn Theodore, b.—April 19, 1912, Ishpeming, Michigan. When Seaborg was ten his family moved to California. He graduated in 1929 from David Star Jordan High School, Los Angeles.

Seaborg obtained his Ph.D. in chemistry from the University of California, Berkeley, in 1937. He became Instructor in 1939 at the University of California, Assistant Professor in 1941, and Professor in 1945. During 1954-61 he was Associate Director of the Lawrence Radiation Laboratory, which was being operated by the University of California for the Atomic Energy Commission. He was appointed to the first General Advisory Committee of Atomic Energy Commission by President Truman in 1946. He served as the Chancellor of the University of California, from 1958 until his appointment by President Kennedy as the Chairman of the US Atomic Energy Commission in 1961.

Seaborg studied and discovered transuranium elements. The chemical characteristics of these new elements have been established by developing a refined ultra-microchemical experimental technique.

SEABORG, GLENN THEODORE
USA

Seaborg and his colleagues are responsible for the identification of more than 100 isotopes of elements. His studies have made it possible to predict the radioactive characteristics of many isotopes of elements still to be found. Under his leadership, numerous methods and instruments were developed, and these have become a cornerstone of modern nuclear chemistry.

Seaborg has written many books and has published approximately 200 scientific papers. Winner of innumerable awards and medals, he holds honorary degrees from many universities. He is also a fellow of several scientific societies.

Seaborg married in 1942 Helen L. Griggs, then Secretary to Dr. Ernest Lawrence, Nobel Laureate in Physics, 1939; they have six children.

Seaborg's chief interest is golf.

Note: The 1951 prize was awarded jointly to McMillan and Seaborg.

Physiology or Medicine

For his discoveries concerning yellow fever and how to combat it.

Theiler, Max, b.—January 30, 1899, Pretoria, South Africa, d.—August 11, 1972, New Haven, Connecticut. Theiler's discovery that mice are susceptible to yellow fever facilitated research and eventual development of a vaccine against the disease in human beings.

THEILER, MAX
Union of South Africa

He received his early education in South Africa and Switzerland and his medical training at St. Thomas' Hospital, London, and the London School of Hygiene and Tropical Medicine, graduating in 1922. In that year he joined the department of tropical medicine at the Harvard Medical School. There his studies of infectious diseases, among them yellow fever, led to development of the first attenuated strain of the virus. From 1930 to 1964, he continued his research at the Rockefeller Institute for Medical Research, New York City, where with his associates he developed the improved (17-D) vaccine, widely used for human immunization against yellow fever.

Literature

For the artistic vigour and true independence of mind with which he endeavours in his poetry to find answers to the eternal questions confronting mankind.

Lagerkvist, Pär Fabian, b.—May 23, 1891, Vaexjoe, Sweden, d.—July 11, 1974, Stockholm. A novelist, poet, dramatist and an internationally known Swedish literary personality of the first half of the twentieth century. His grandparents were peasants, and his father was a railway workman, but Pär received university education.

The influence of modern science made him an atheist. He identified himself as a socialist until he took to literary radicalism which was expressed in an essay entitled, *Ordkonst och bildkonst* (1913, Verbal and Pictorial Art). Extreme pessimism pervaded his works during World War I which was revealed in *Motiv* (Themes, 1914), *Jaern Och maenniskor* (Iron & Men, 1915) and *Angest* (Anguish, 1916.) He became more optimistic in *Det eviga leendet* (1920, The Eternal Smile, 1934), which led to a collection of poems *Den lychliges vag* (The Road of the Happy Man, 1921).

LAGERKVIST, PÄR FABIAN
Sweden

His autobiography is reflected in *Gaest hos Verkligheten* (1925, Guest of Reality, 1936). He wrote a great monologue in prose named *Det besegrade livet* (1927, The Triumph over Life) which became a positive point of departure from his faith. His prose work *Boedeln* (1933, The Hangman, 1936), which was later dramatised, is a protest against the everlasting brutality in the world. The dramas *Mannen utan sjael* (1936, The Man without a Soul, 1944) and *Seger i moerker* (Victory in the Darkness, 1939) are an expression of his indignation to Fascism. The play *Laet Maenniskan leva* (1949, Let Man Live, 1951) deals with man's readiness to judge his fellows and to condemn them. The novel *Dvaergen* (1944, The Dwarf, 1945) was a bestseller. With *Barabbas* (1950, English, 1951) he gained international recognition.

His later works include *Sibyllan* (The Sibyl, 1956), two short stories, *Ahasverus' dod* (The Death of Ahaseurus, 1960), *Pilgrim pa havet* (Pilgrim of the Sea, 1962), and a collection of poems *Aftonland* (Evening land, 1953).

Peace

JOUHAUX, LÉON
France

Jouhaux, Leon, b.—July 1, 1879, Paris, d.—April 28, 1954, Paris. A socialist and trade-union leader who was one of the founders of the International Labour Organization (ILO). He was a worker in a match factory from the age of 16. Jouhaux became one of the leading propagandists of revolutionary syndicalism. He became the National Secretary of the match workers' union by 1906, and was appointed secretary general of the *Confederation Generalé du Travail* in 1909. Before World War I he joined with German labour leaders in an attempt to organize an antimilitary movement; but subsequently he supported the French War effort. In 1916, at the Conference of Allied Trade Unions, he submitted a report in which he depicted the future ILO. He attended the Versailles Peace Conference in 1919, which set up the International Labour Legislation Commission of which he was one of the most active members, and from this time he also urged the foundation of the Economic Council, which was set up in 1925. He believed that trade unionism should have a role in directing the economy but insisted that trade-union action must remain independent of political action.

During World War II, the Vichy government arrested him and turned him over to the Germans; he spent the rest of the war in a German concentration camp. In 1949, he helped to found the International Confederation of Free Trade Unions.

1952

PHYSICS

Purcell, Edward Mills / Bloch, Felix

CHEMISTRY

Martin, Archer John Porter
Synge, Richard Laurence Millington

PHYSIOLOGY OR MEDICINE

Waksman, Selman Abraham

LITERATURE

Mauriac, Francois

PEACE

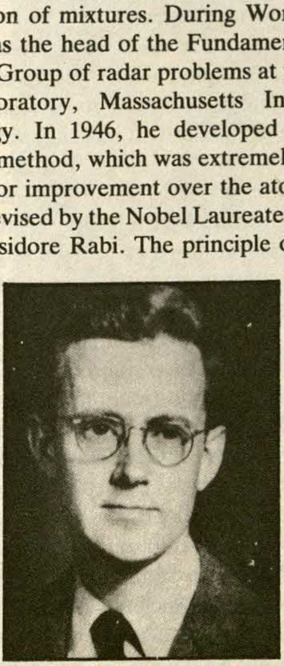
Schweitzer, Albert

1952

Physics

For their development of new methods for nuclear magnetic precision measurements and discoveries in connection therewith.

Purcell, Edward Mills, b.—August 30, 1912, Taylorville, Illinois. A joint winner with Felix Bloch of the USA of the prize for his independent discovery of "nuclear magnetic resonance" (NMR) in liquids and in solids, a phenomenon useful in measuring the nuclear magnetic moment of atomic nuclei and molecules. Nuclear magnetic resonance is now being widely used to study the molecular structure of pure materials and the composition of mixtures. During World War II Purcell was the head of the Fundamental Developments Group of radar problems at the Radiation Laboratory, Massachusetts Institute of Technology. In 1946, he developed his NMR detection method, which was extremely accurate and a major improvement over the atomic beam method devised by the Nobel Laureate American physicist Isidore Rabi. The principle of NMR is now being used for the detection and localization of intracranial space-occupying lesions.



PURCELL, EDWARD MILLS
USA

Purcell became professor of physics at Harvard University in 1949. Later he succeeded in detecting the 21 centimetre wavelength microwave radiation emitted by neutral atomic hydrogen in interstellar space. Such radio waves were predicted by the Dutch astronomer van de Hulst in 1944, and their study enabled astronomers to determine the distribution and location of hydrogen clouds in galaxies and to measure the rotation of the Milky Way. In 1960, Purcell became Gerhard Gade Professor at the Harvard University and in 1962 he was appointed to the Science Advisory Committee of the US President.

◆

For their development of new methods for nuclear magnetic precision measurements and discoveries in connection therewith.

Bloch, Felix, b.—October 23, 1905, Zürich, Switzerland, d.—1983. A recipient of the prize for developing the nuclear induction method of measuring the magnetic field of atomic nuclei. Bloch had his early education at Zürich. Later he graduated from the University of Leipzig in Germany. He also obtained his Ph.D. in 1928 from the same university. He was appointed Professor at Leipzig in 1932. However, he left Germany in 1933, and worked at various institutions in Holland, Denmark and Italy. In 1934 he migrated to USA and became a citizen in 1939. In 1934, he conceived of a method for polarizing neutrons while working at the Stanford University. In 1939, using this method, he and Luis Alvarez (1968 Nobel Prize for Physics) measured the magnetic moment of the neutron. He worked on atomic energy and antiradar devices during World War II and returned to Stanford in 1945 to develop the principle of nuclear induction with Hansen

BLOCH, FELIX
Switzerland/USA

and Packard. This was an important development because it helped to establish the relationship between nuclear magnetic fields and the crystalline and magnetic properties of various materials. Nuclear induction later became useful in determining the composition and structure of molecules. Bloch also developed the nuclear magnetic resonance method for chemical analysis. In 1954 and 1955 he served as the Director-General of CERN at Geneva,

Note: The 1952 prize was awarded jointly to Bloch and Purcell.

Chemistry

For their invention of partition chromatography.

Martin, Archer John Porter, b.—March 1, 1910, London. Son of a medical practitioner, Martin attended Bedford School from 1921 to 1929. He graduated from Cambridge University in 1932. He wanted to study chemical engineering, but due to the influence of Professor I.B.S. Holdane, then Reader of Biochemistry at Cambridge, he eventually specialized in biochemistry. Martin worked for a year in the Physical Chemistry Laboratory and then obtained a post at the Duna Nutritional Laboratory. In 1938 he joined the Wool Industries Research Association at Leeds. Martin was appointed Head of the Biochemistry Division of the Research Department of Boots Pure Drug Company at Nottingham in 1946. In 1948 he joined the Medical Research Council at Lister Institute and later the National Institute for Medical Research. In 1952 he was appointed Head of the Division of Physical Chemistry at the Institute, and he was chemical consultant from 1956 to 1959. Since 1959 he has been a Director of Abbotsbury Laboratories Ltd.

MARTIN, ARCHER JOHN PORTER
Great Britain

In 1943 he married Judith Bagenal; they have one son and three daughters.

Martin along with Richard Synge invented partition chromatography, which has given science a new tool, and has proved its usefulness in a number of investigations. It has enabled research workers in chemistry, biology and medicine to tackle and solve problems which were earlier considered complicated. Martin's other contributions include the perfection of gas chromatography, a process for separating various chemical vapours by different absorption on a porous solid, felting of wool and an amino-acid analysis. His earlier researches resulted in a method of detecting pyio-electricity by observing the attraction of metal plate for crystals that had been immersed in liquid air. He had also worked on ultraviolet absorption spectra.

He was elected fellow of the Royal Society in 1950, and made companion of the British Empire in 1960. He has received the Berzelius Medal of the Swedish Medical Society (1951), John Scott Award (1958), John Price Wetherill Medal (1959), Franklin Institute Medal (1959), and Level-hulene Medal (1963). In 1963, he was appointed to deliver special lectures at the Technological University of Eindhoven in the Netherlands. ◆

For their invention of partition chromatography.

Synge, Richard Laurence Millington, b.—October 28, 1914, Liverpool. He joined Winchester College in 1928 where he studied classics until 1931, thereafter natural sciences. In 1933 he went to Trinity College, Cambridge University, and studied physics, chemistry and physiology. In 1941 he obtained his Ph.D. from Cambridge.

Synge joined the staff of the Wool Industries Research Association at Leeds in 1941. In 1943 he joined the Lister Institute of Preventive Medicine, London. He has been the Head of the Department of Protein Chemistry at the Rowett Research Institute near Aberdeen, since 1948. In 1951 Synge and four other scientists formed a "Science for Peace" Committee.

Synge married Dun Stephen in 1943; they have four daughters and three sons.

SYNGE, RICHARD LAURENCE MILLINGTON
Great Britain

The collaboration between Synge and Martin resulted in the invention of partition chromatography. In his Nobel Lecture on "Applications of Partition Chromatography," Synge elucidated the practical use of their invention. Their method of partition chromatography has given the possibility of exhaustive analysis of complete hydrolysates of proteins. It has firmly established that the vast majority of proteins rejected on hydrolysis are only the well-known amino-acids and that these account for the entire substance of the protein molecule. Partition chromatography has thrown much light on the free amino-acids and related compounds found in living organisms. It has been valuable for assessing the purity of amino acids and simple peptides.

Partition chromatography is used for determining ultimate hydrolysis products of polysaccharides qualitatively and quantitatively. It is also used in pharmacological studies. This method makes it cheaper and quicker, the various analytical operations used in industrial research and routine control of production. It facilitates in many obvious ways the work of those engaged in the control of foods and drinks, in clinical laboratories and generally in the safeguarding of the public health, which makes adulterations difficult. There are many more important applications of partition chromatography.

Synge was made a Fellow of the Royal Society in 1950 and of the Royal Institute of Chemistry in 1952. He is an honorary member of the American Society of Biological Chemists.

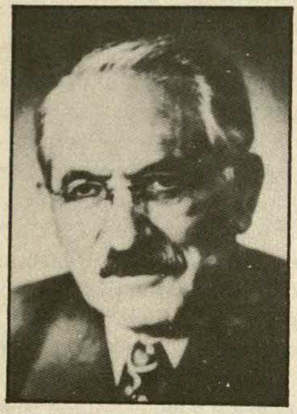
Note: The 1952 prize was awarded jointly to Synge and Martin.

Physiology or Medicine

For his discovery of streptomycin, the first antibiotic effective against tuberculosis.

Waksman, Selman Abraham, b.—July 22, 1888, Priluka, now Ukraine, d.—August 16, 1973, Hyannis, Massachusetts. A microbiologist who is considered to be one of the world's foremost authorities on soil microbiology. After the discovery of penicillin, he played a major role in initiating a well-planned systematic search for antibiotics among microbes. He discovered the antibiotic streptomycin, the first specific agent effective in the treatment of tuberculosis.

As a naturalized American citizen he spent most of his career at Rutgers University, New Brunswick, New Jersey, where he was the professor of soil microbiology, professor of microbiology, chairman of the department of microbiology and director of the Rutgers Institute of Microbiology. During his extensive study of the actinomycetes he extracted from them "antibiotics" (*a term he coined in 1941*) valuable for their killing effect not only on gram-positive bacteria, like penicillin, but also on gram-negative bacteria, of which the tubercle bacillus is a deadly one.



WAKSMAN, SELMAN ABRAHAM
USA

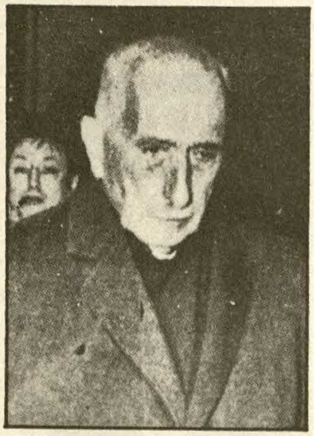
In 1940, he and his associates isolated actinomycin from soil bacteria, but found it to be extremely toxic when administred to laboratory animals. This was later used in the treatment of cancer. Three years later they extracted the relatively nontoxic streptomycin from the actinomycete *streptomyces griseus* and found that it retarded the proliferation of *Mycobacterium tuberculosis*. In combination with other chemotherapeutic agents, streptomycin has become a major agent in eradication of tuberculosis. Waksman also isolated and developed several other antibiotics, including neomycin, which are used in treating many infectious diseases of humans, domestic animals, and plants.Among his books are *Principles of Soil Microbiology* (1927) which is regarded as one of the most exhaustive works on the subject in any language, and *My Life with the Microbes* (1951) is his autobiography.

Literature

For the deep spiritual insight and the artistic intensity with which he has in his novels penetrated the drama of human life.

Mauriac, Francois, b.—October 11, 1885, Bordeaux, France, d.—September 1, 1970, Paris. A novelist, essayist, playwright and journalist. He was born in a pious catholic upper middle class family. He studied at the University of Bordeaux and entered the Ecole Nationale des Chartes at Paris in 1906.

He published a volume of poems in 1909, *Les mains jointes* (Joined Hands). His first novels were *L' enfant charge de chaines* (1913, Young Man in Chains, 1961) and *La Robe Pretexte*, (1914, The Stuff of Use, 1960). *La Chair et la Sang* (Flesh and Blood, 1920), *Preseances* (Questions of Precedence, 1921) followed, but *Le Baiser au lepreux* (1922, The Kiss to the Leper, 1923) established him as a novelist. He showed increased mastery in *Le Desert de l' amour* (The Desert of Love, 1925) which won him the Grand Prix du Roman of the Academie Francaise in 1925. His other famous works include: *Therese Desqueyroux* (1927, Therese, 1928), *Le Neeud de viperes* (1932, The Vipers Tangle, 1933), *Le Mystere Frontenac* (1933, The Frontenac Mystery. 1951), *Le Mal* (Evil, 1935), *Les Anges noirs* (Black Angels, 1936), *Les Chemins de la mer* (1939, The Unknown Sea, 1962), *La Pharisienne* (1941, A Woman of Pharisees, 1946). He wrote many plays of which *Asmodee* (English, 1939), *Les Mal Aimes* (1945, The Poorly Loved) are still known.



MAURIAC, FRANCOIS
France

He wrote the *Le Romancier et ses personnages* (1933, The Novelist and His Characters) in four volumes, which was followed by his *Memoires* (1959-67).

Peace

Schweitzer, Albert, b.—January 14, 1875, Kaysersberg, Upper Alsace, now in France, d.—September 4, 1965, Lambarene, Gabon Republic in West Africa. A theologian, philosopher and organist acclaimed for his interpretations of Johann Sebastian Bach's works. He was also a mission doctor in equatorial Africa, and received the prize for his efforts on behalf of "the Brotherhood of Nations." He was the eldest son of a Lutheran pastor, and studied philosophy and theology at Strasbourg, where he took a doctor's degree in philosophy. At the same time, he was also a lecturer in philosophy and a preacher at St. Nicholas' Church. He also received a doctorate in theology. His book *The Quest of the Historical Jesus* (1910) established him as a world figure in theological studies. In this and other works he stressed the historical views perceived in the lives of Jesus and St. Paul. During these years Schweitzer became an accomplished musician, beginning his career as an organist in Strasbourg and as an accompanist for Bach concerts. Charles-Marie Widor, his organ teacher in Paris, recognized Schweitzer as a Bach interpreter of unique perception and asked him to write a study of the composer's life and art. The result was *Jean Sebastian Bach le musicien poete* (Johann Sebastian Bach the poetic musician) which was expanded in a new edition of which an English translation was made. In this work Schweitzer viewed Bach as a religious mystic and likened his music to the impersonal and cosmic forces of the natural world.

In 1905, Schweitzer announced his intention to became a mission doctor in order to devote himself wholeheartedly to philanthropic work. He resigned his university positions in 1905 and become a doctor of medicine in 1913. The previous year he had married Helene Bresslau, an accomplished scholar who trained as a nurse in order to be of help to her husband. Together they set out for Lambarene in the Gabon province of French Equatorial Africa. There on the banks of the Ogooue (Ogowe) river, Schweitzer, with the help of the local people, built his hospital, which he equipped and maintained from his income, which was later supplemented by gifts from individuals and foundations in many countries. Somewhat patriarchal in his hospital management, he exercised a shrewd business sense and retained control over every detail. He was briefly interned there as a German, and later in France as a prisoner of war during World War I. He turned his attention increasingly to world problems and was moved to write his *Kulturphilsophie* (1923) (*Philosophy of Culture*). In the second of its two volumes he set forth his personal philosophy of "reverence for life", an ethical principle involving all living things, which he believed essential to the survival of civilization.

SCHWEITZER, ALBERT
France

Schweitzer returned to Africa in 1924 to rebuild the almost defunct hospital, which he relocated up the Ogooue River; a leper colony was added to it later. By 1963, there were 350 patients with their relatives at the hospital and 150 patients in the leper colony, all served by about 36 white physicians, nurses, and varying numbers of local workers.

Schweitzer never abandoned his musical and scholarly interests. He published *Die Mystik des Apostels Paulus* (1930, The Mysticism of Paul the Apostle, 1931). He gave lectures and music recitals throughout Europe and made recordings, and resumed his editing of Bach's works, beginning with Widor in 1911 (*Bachs Orgelwerke*, 1912-14). His address upon receiving the prize, *Das problem des Friedens in der heutigen Welt* (1954, The Problem of Peace in the World of Today, 1954) had a worldwide circulation. In 1958 he broadcast from Oslo three appeals to the world, issued as *Friede oder Atomkrieg*? (Peace or Atomic War?).

Among his several autobiographical works, *Aus meinem Leben und Denken* (1931, Out of My Life and Thoughts, 1933) covers the major part of his career. Despite the occasional criticisms of his medical practice as being autocratic and primitive, and despite the opposition sometimes raised against his theological works, Schweitzer's influence continues to have a strong moral appeal, frequently serving as a source of encouragement for intending medical missionaries.

1953

PHYSICS

Zernike, Frits

CHEMISTRY

Staudinger, Hermann

PHYSIOLOGY OR MEDICINE

Krebs, Sir Hans Adolf / Lipmann, Fritz Albert

LITERATURE

Churchill, Sir Winston Leonard Spencer

PEACE

Marshall, George Catlett

1953

Physics

For his demonstration of the phase contrast method, especially for his invention of the phase contrast microscope.

Zernike, Frits, b.—July 16, 1888, Amsterdam, d.—March 10, 1966, Groningen, Netherlands. A winner of the prize for invention of the "phase-contrast microscope", an instrument that permits the study of internal cell structure without the need to stain and the death of the cells. Zernike joined the faculty of the State University of Groningen as professor of mathematical physics and theoretical mechanics in 1915 and served as a full professor from 1920 to 1958. His earliest work in optics was concerned with astronomical telescopes. While studying the flaws which occur in some diffraction gratings because of imperfect spacing of the engraved lines, he discovered the phase-contrast principle. He noted that he could distinguish the light rays that passed through different transparent materials. He built a microscope using that principle in 1938. In 1952, Zernike was awarded the Rumford medal by the Royal Society of London.

ZERNIKE, FRITS (FREDERIK)
The Netherlands

Chemistry

For his discoveries in the field of macromolecular chemistry.

Staudinger, Hermann, b.—March 23, 1881, Worms, now in Germany, d.—September 8, 1965, Freiburg-im-Breisgau. Son of Dr. Franz Staudinger, Hermann did his schooling in Worms, matriculating in 1899. He studied at the Universities of Halle, and later at Darmstadt and Munich. He received his Ph.D. from the University of Halle.

Staudinger was appointed professor of organic chemistry at the Institute of Chemistry of the Technische Hochschule in Karlsruhe in 1907. He was lecturer at the Eidgenossische Technische Hochschule in Zürich, for 14 years. He became a lecturer of chemistry at the university of Freiburg-im-Breisgau in 1926. He held an additional appointment as Principal of the Research Institute for Macromolecular Chemistry from 1940 onwards. In 1951 he was appointed honorary Head of this Institute, which he held until 1956.

Staudinger was married to Magda Woit, who for many years was his co-worker and co-author of a number of publications.

In early 1920 Staudinger expressed the view that a molecule could be very large, that such macromolecules could very easily, sometimes with apparent spontaneity, be formed of a very large number of atoms (10,000 or 100,000) and that the particles of colloidal solutions were in many cases actual molecules of this type. He said that the formation of high polymers occurs when the ends of the atomic chains due to some difficulty do not close to form a ring, but link up with other molecules which in turn capture new molecules and so the chain grows until the process is interrupted by some external circumstance. He provided proof for his macromolecular theory.

STAUDINGER HERMANN
Germany

Macromolecular products are created in various ways. Polymerization, constituting a particular chain reaction, is of major importance. Research conducted by Melville and others showed that polymerization processes are more complex than had formerly been assumed and that the resultant products are mixtures of polymer isomers. Macromolecular substances can be produced by polycondensation.

Staudinger was a prolific writer and has written several books. He edited the periodical *Macromolecular Chemistry*. He has also published many scientific papers.

Staudinger has received many honours and awards. He was awarded the Cannizzarro Prize of Reale Accademia Nazionale die Lincci in Roma. He is a member of the Institut de France, and of the Society of Macromolecular Chemistry, Tokyo.

Physiology or Medicine

For his discovery of the citric acid cycle.

Krebs, Sir Hans Adolf, b.—August 25, 1900, Hildesheim, West Germany, d.—November 22, 1981, London. Krebs was the son of a Jewish physician and attended several universities—Göttingen, Freiburg, Munich, Berlin and Hamburg. He gained his M.D. degree at Hamburg in 1925 and for the next five years did research in biochemistry under Otto Warburg in the Kaiser Wilhelm Institute for Biology, Berlin-Dahlem. In 1930 he took up a clinical appointment in biochemistry in Freiburg, and continued his research with the support of the Rockefeller Foundation. When the Nazis came to power, Krebs' position became intolerable, but he was able to continue his work at Cambridge due to the invitation extended by Sir Frederick Gowland Hopkins with the continued support of the Rockefeller Foundation. Two years later (1935), he was appointed lecturer of Pharmacology at the University of Sheffield and subsequently in 1938 as lecturer of biochemistry. The same year he married Margaret Cicely Fieldhouse. They had two sons and a daughter. In 1945 the University appointed him to a newly created Chair of Biochemistry and he also became Director of the Cell Metabolism Research Unit established by the Medical Research Council.

In 1954, Krebs went to Oxford to take up the Whitley Chair of Biochemistry which he held until his retirement in 1967. Even after retirement he continued his research in the Nuffield Department of Clinical Medicine, in Oxford, and he was appointed Visiting Professor of Biochemistry at the Royal Free Hospital, London.

KREBS, Sir HANS ADOLF
Germany/Great Britain

Krebs' interest lay in the investigation of metabolic pathways. At the University of Freiburg, he discovered with the German biochemist Kurt Henseleit a series of chemical reactions called the "urea cycle", occurring in mammalian tissues by which ammonia is converted to urea. Urea, which is far less toxic to mammalian organisms than ammonia, is subsequently excreted in the urine of most mammals. This cycle also serves as a major source of the amino acid arginine.

Krebs also discovered in living organisms a series of chemical reactions known as the citric acid cycle, also called the tricarboxylic acid cycle or "Krebs cycle". These reactions involve the conversion in the presence of oxygen, of substances formed by the breakdown of sugars, fats and protein components, to carbon-dioxide, water and energy-rich compounds. Discovery of the citric acid cycle to which nearly all metabolic reactions are connected and the source of two-thirds of the energy derived from food ingested by higher organisms, is of prime importance to even a rudimentary understanding of cellular metabolism and molecular biology.

Krebs measured the amounts of certain four-carbon and six-carbon acids generated in pigeon liver and breast muscle when sugars are oxidised completely to yield carbon-dioxide, water and energy. In 1937, he was able to demonstrate the existence of a cycle of chemical reactions that combines the end-product of sugar breakdown, later shown to be an "activated" form of the two carbon acetic acid, with the four-carbon oxaloacetic acid to form citric acid. The cycle regenerates oxaloacetic acid through a series of intermediate compounds while liberating carbon-dioxide and electrons that are immediately utilized to form high-energy phosphate bonds in the form of adenosine triphosphate.

In 1957 in association with Hans Kornberg, a biochemist, he wrote *Energy Transformations in Living Matter*. Krebs' original work gained him many honours. He was elected Fellow of the Royal Society in 1943. In 1953, he shared the prize with Fritz Lipmann, another pioneer of metabolic processes, for his discovery of the citric acid cycle. Krebs was knighted in 1958.

◆

For his discovery of co-enzyme A and its importance for intermediary metabolism.

Lipmann, Fritz Albert, b.—June 12, 1899, Koenigsberg, Germany, now Kaliningrad, Russia. Lipmann was educated at the Universities of Koenigsberg and Berlin. He was a Research Assistant in Kaiser Wilhelm Institute, Berlin and Heidelberg, 1927-31; Research Fellow in Rockefeller Institute for Medical Research, New York, 1931-32; Research Associate, Biological Institute of Carlsberg Foundation, Copenhagen, 1932-39; Research Associate, Department of Biological Chemistry, Cornell University Medical School, New York, 1939-41; Research Fellow in Surgery, Harvard Medical School, Boston, 1941-43 and Associate in Biochemistry, 1943-49. He became Professor of Biological Chemistry, Harvard Medical School, Massachusetts General Hospital, Boston, 1949-57, and Professor of Rockefeller University, New York, 1957. He married Freda Hall in 1931 and has a son.

LIPMANN, FRITZ ALBERT
Germany/USA

At Massachusetts General Hospital, where he directed the Biochemistry Research Department, and as Professor of Biological Chemistry at Harvard Medical School, Boston, he found the presence of a catalytically active, heat-stable factor in pigeon liver extracts. He subsequently isolated the substance and determined its molecular structure and named it Coenzyme A or CoA, which is now known to be bound to acetic acid as the end product of anaerobic sugar and fat breakdown. In addition, he has done outstanding work on energy metabolism and the metabolic function of B Vitamins.

Lipmann is a member of National Academy of Sciences, Foreign member of Royal Society of New York and a honorary D.Sc. He received the National Medal of Science in 1966.

Lipmann's publications include *Wanderings of a Biochemist* (1971) and *Annual Review of Bio-*

chemistry (Opening chapter, 1984).

Note: The 1953 prize was awarded jointly to Lipmann and Krebs.

Literature

For his mastery of historical and biographical description as well as for brilliant oratory in defending exalted human values.

Churchill, Sir Winston Leonard Spencer, b.—November 30, 1874, Blenheim Palace, Oxfordshire, d.—January 24, 1965, London. An author, orator and able statesman who was Prime Minister of England from 1940 to 1945 and led Britain to victory in World War II from almost certain defeat. He graduated from the Royal Military College at Sandhurst and served as a subaltern and a war correspondent in the Boer War in South Africa.

CHURCHILL, Sir WINSTON LEONARD SPENCER
Great Britain

His first book *Story of the Malakand Field Force* (1898) was followed by *The River War* (1899). In 1900, his only novel *Savrola* was published.

In 1900, he entered politics and the British Parliament as a conservative member, but, in 1904, he broke off from the party and joined the Liberal Party. He became a member of the Cabinet in 1908, first holding the post of President of the Board of Trade and then that of Home Secretary. He joined the admiralty in 1911 and strengthened the British Navy. After the onset of World War I, he resigned from the post and served as a combatant officer (1915-16) and then as the minister of munitions (1917-18). This led to *The World Crisis* (1923-29). After the war he served as the Colonial Secretary and Chancellor of the Exchequer, and gradually reverted to his conservative outlook.

It was during the 1930s that his works like *My Early Life* (1930), *Thoughts and Adventures* (1932), *Marlborough* (1933-38) and *Great Contemporaries* (1937) appeared. In 1939, he was reappointed to the leadership of the Admiralty and following the German invasion of the Netherlands he was installed as the British Prime Minister. He rallied the British nation to resist the Axis Powers despite the miserable fall of France and fighting together with the USA and Soviet Union led them to ultimate victory. After the war his party was voted out of power but he again became the Prime Minister in 1951.

He wrote his masterpiece *The Second World War* after his retirement in 1955 and also wrote a four-volume *History of the English Speaking Peoples* (1956-58). He was also a painter of distinction.

Peace

Marshall, George Catlett, b.—December 31, 1880, Uniontown, Pennsylvania, d.—October 16, 1959, Washington, D.C. A four-star general of the US army and its chief of staff during World War II, he was also US Secretary of State (1947-49) and Secretary of Defense (1950-51).

MARSHALL, GEORGE CATLETT
USA

The post-war European Recovery Program was proposed by him in 1947. It became famous as the Marshall Plan. He became an army officer in 1902 and spent 18 months in the Philippine Islands. In World War I he served in France as a chief of operations, then he became General Pershing's aide and an infantry instructor. Marshall was elevated to the post of army chief of staff when World War II broke out in 1939 and in that capacity expanded the army to over 8 million men and strongly advised at Allied conferences for invasion of France. After resigning in 1945, he tried unsuccessfully to mediate the Chinese civil war. He received the prize for his efforts in the revival of Europe after World War II.

1954

PHYSICS

Born, Max

Bothe, Walther Wilhelm Georg Franz

CHEMISTRY

Pauling, Linus Carl

PHYSIOLOGY OR MEDICINE

Enders, John Franklin

Robbins, Frederic Chapman

Weller, Thomas Huckle

LITERATURE

Hemingway, Ernest Miller

PEACE

Office of the United Nations High Commissioner for Refugees

1954

Physics

For his fundamental research in quantum mechanics, especially for his statistical interpretation of the wavefunction.

Born, Max, b.—December 11, 1882, Breslau, Germany, now Wroclaw in Poland, d.—January 5, 1970, Göttingen, Germany. A winner of the prize with Walther Bothe for statistical studies of wave functions. This work led to the replacement of the original quantum theory, which regarded electrons as particles, with an essentially mathematical description representing their behaviour more accurately. In 1921, he became professor of theoretical physics at the University of Göttingen. He reformulated the first law of thermodynamics. He produced a very precise definition of quantity of heat and thus provided the most satisfactory mathematical description of this law. In 1926, immediately after his student Heisenberg had formulated the first laws of a new quantum theory of atoms, Born collaborated with him to develop the mathematical formulation that would adequately describe it. Somewhat later, when Schroedinger put forward his quantum mechanical wave equation, Born showed that the solution of the equation has a statistical meaning of physical significance. His interpretation of the wave equation has proved to be of great importance in the new quantum theory. Born also developed a theory of collisions of subatomic particles and introduced a useful technique known as the "Born approximation", in which perturbation theory is applied to problems concerning the scattering of the atomic particles. He helped to formulate the "Born-Oppenheimer theory of molecules", which deals with inter atomic forces, and contributed to the study of crystallography and the kinetic theory of fluids. In 1933, Born, a Jew, fled the Nazis, took refuge in England and became Stokes lecturer at the University of Cambridge. He was made a British subject in 1939 and was elected to the Tait Chair of Natural Philosophy at the University of Edinburgh in 1936. After his retirement in 1953 he returned to Göttingen, where he wrote many articles and books on the responsibility of scientists for the use of nuclear energy in war and peace and condemned the use of contemporary scientific knowledge for warfare. His *Selected Papers* appeared in 1963.

BORN, MAX
Germany/Great Britain

◆

For the coincidence method and his discoveries made therewith.

Bothe, Walther Wilhelm Georg Franz, b.—January 8, 1891, Oranienburg, in East Germany, d.—February 8, 1957, Heidelberg. A winner of the prize with Max Born for invention of a new method of detecting subatomic particles and for other resulting discoveries. Before World War II, Bothe taught at the Universities of Berlin, Giessen, and Heidelberg. In 1925, he and the noted physicist, Hans Geiger, used two Geiger counters to gather data on the "Compton effect", the process that occurs when a photon strikes a stationary electron and gives up to the electron part of its energy of motion. They found that the photon is bounced off in one direction and the electron recoils in another. From the data of this experiment, the particle nature of light waves was definitely established.

BOTHE, WALTHER
Germany

With the German astronomer Kolhoerster, he devised a new method of arranging two Geiger counters to count two particles arriving at each counter simultaneously. He applied this method to the study of cosmic rays in 1929 and found that cosmic rays are not composed exclusively of gamma rays, as was previously believed. In 1930, he discovered an unusual radiation emitted by beryllium when bombarded with alpha particles. This radiation was later identified by Chadwick of England (Nobel Laureate) as the neutron.

In 1934, Bothe was appointed director of the Institute of Physics at the Kaiser Wilhelm Institute (now called the Max Planck Institute) in Heidelberg. During World War II he was one of Germany's leading scientists working on the nuclear energy project. He did theoretical work on neutrons and their role in atomic reactions and was responsible for planning and building Germany's first cyclotron, which was completed in 1943. From 1946, he held the chair of physics in the University of Heidelberg.

Note: The 1954 prize was awarded jointly to Bothe and Born.

Chemistry

For his research into the nature of the chemical bond and its application to the elucidation of the structure of complex substances.

Pauling, Linus Carl, b.—February 28, 1901, Portland, Oregon, USA, d.—1981. He obtained his Ph.D. from California Institute of Technology in 1925. He was awarded Honorary D.Sc. by many universities like Oregon State College (1933), University of Chicago (1941), Princeton University (1946), Yale (1947), Cambridge (1955), Humboldt University in Berlin (1959), Melbourne (1964) and York in Toronto, Canada (1966).

PAULING, LINUS CARL
USA

He started his career at Oregon State College as an Assistant in Chemistry and in Mechanics and Materials (1919-22). He joined the California Institute of Technology as a Graduate Assistant (1922-23) and was a Teaching Fellow (1923-25) and Research Associate (1925-26). A Guggenheim Fellowship took him to Munich to study for a year with Arnold Sommerfeld, then to Copenhagen and Zürich for another year of work with Niels Bohr (Nobel Laureate for Physics, 1922) and Erwin Schrödinger (Nobel Laureate for Physics, 1933). In this stimulating climate Pauling's interest centered on the forces that bind atoms into molecules. The result was a famous book, *The Nature of the Chemical Bond*. Pauling returned to California Institute of Technology as an Assistant Professor (1927-29), was Associate

Professor during 1929-31 and Professor during 1931-63. He was Professor of Chemistry at Stanford University during 1969-74.

He started working on what he called the "simple" molecular structures, and concentrated on an organic molecule, haemoglobin, the protein that gives blood its red colour. During his work he discovered that in arterial blood this large protein molecule is repelled by a magnet. He went on to study the chemical bond between haemoglobin and the oxygen it picks up in the lungs and beyond such problems, the principles that control the basic process of life. He also saw that the key to the secret of this problem was held by proteins. As Pauling got absorbed in his protein experiment, four of his post-doctoral assistants spent a year each working out the structure of one crystal, the amino acid, *threonine*. As he and his group proceeded, Pauling found, "When asymmetric objects in space are joined together in such a way that each has the same geometrical relationship to its neighbours, a helix is formed." Unexpected help in the form of additional evidence came from some X-ray photographs of synthetic protein strands made by a group of English scientists, C.H. Bamford, W.E. Hanby and F. Happey. Further proof came from Max Perutz (Nobel Laureate in Chemistry, 1962) in the form of further X-ray pictures. For tracking down the general shape and organization of proteins, he was awarded the prize. His contributions to the understanding of chemical bonding is phenomenal.

Pauling was an ardent pacifist and campaigned for control of atomic weapons and international control over nuclear weapons. His book *No More War!* (1958) was an instant bestseller.

A prolific writer, his other works include *General Chemistry* (1947), *College Chemistry* (1950), *Vitamin and the Common Cold* (1971) and numerous scientific articles. Pauling was in the run for yet another great discovery, when he narrowly lost the race for identifying the ultimate chemical units of life, the DNA, to Watson and Crick (Nobel Laureates for Physiology or Medicine, 1962). The breathtaking pace at which the two groups worked towards the solution has been beautifully narrated by Watson in his famous book *Double Helix*.

Pauling married in 1923 and had three sons.

He received the Nobel prize for Peace in 1962 for his pacifist campaign against atomic warfare.

Physiology or Medicine

For their discovery of the ability of poliomyelitis viruses to grow in cultures of various types of tissue.

Enders, John Franklin, b.—February 10, 1897, at West Hartford, Connecticut, USA. For four years he studied English literature and Germanic and Celtic languages with the idea of becoming a teacher of English, but was not satisfied. He had been for a long time interested in biology and this interest was reawakened by his friendship with some medical students at Harvard. He, therefore, decided to study bacteriology and immunology.

ENDERS, JOHN FRANKLIN
USA

In 1930, Enders received his Ph.D. from Harvard for a thesis which presented evidence that bacterial anaphylaxis and hypersensitivity of the tuberculin type are distinct phenomena. In 1938, he began to study mammalian viruses. In 1941, he studied the virus of mumps in collaboration with Cohen, Kane, Levens, Stokers and others.

In 1946, Enders was asked to establish a laboratory for research in infectious diseases at the Children's Medical Centre at Boston. In this laboratory much outstanding work on the viral diseases of man has been done under his direction and it was here that the work was done on the cultivation of the poliomyelitis viruses for which Enders was awarded, together with T.H. Weller and F.C. Robbins, the prize. ◆

For their discovery of the ability of poliomyelitis viruses to grow in cultures of various types of tissue.

Robbins, Frederick Chapman, b.—August 25, 1916, Auburn, Alabama. He was educated at the University of Missouri from where he took his B.S. in 1938. In 1940, he graduated from Harvard Medical School and was appointed as resident physician in bacteriology at the Children's Hospital Medical Centre in Boston, Massachusetts. He continued his training there until 1942 when he left to serve in the United States Army.

ROBBINS, FREDERICK CHAPMAN
USA

During military service he was assigned to the Fifteenth Medical General Laboratory as Chief of the Virus and Rickettsial Diseases Section, and in this capacity served in the United States, North Africa, and Italy. Most of his work during this period consisted of investigation on infective hepatitis, typhus fever, and supervision of a diagnostic virus laboratory.

Returning to civilian life, Robbins resumed his training at the Children's Hospital Medical Centre and completed the same in January 1948. From 1948 to 1950 he held a Senior Fellowship in Virus Diseases of the National Research Council and worked with Dr. John F. Enders in the Research Division of Infectious Diseases. While working with Enders, Robbins chiefly studied the cultivation of poliomyelitis virus in tissue culture and the application of this technique. He also investigated the viruses of mumps, *herpes simplex* and *vaccinia*.

◆

For their discovery of the ability of poliomyelitis viruses to grow in cultures of various types of tissue.

Weller, Thomas Huckle, b.—June 15, 1915, Ann Arbor, Michigan. In 1936, he entered the Harvard Medical School in Boston where he was given, by Drs. E.E. Tyzzer and Donald L. Augustine, facilities for research in the Department of Comparative Medicine and Tropical Medicine. He was accepted, in 1939, as a tutorial student by Dr. J.F. Enders, who introduced him to the field of virus research and to the study of tissue-culture techniques as a means of studying the causes of infectious diseases. In 1940, he took his M.D. degree and began his clinical training at the Children's Hospital in Boston. His work here was, however interrupted by military service in World War II, for he joined the Army Medical Corps and was stationed at the Antilles Medical Laboratory in Puerto Rico. There he was Head of the Department of Bacteriology, Virology and Parasitology and attained the rank of a Major. He then returned to the Children's Hospital, Boston, for a further year of clinical training and, in 1947, joined Dr. Enders in the organization of the new Research Division of Infectious Diseases at the Children's Medical Centre.

WELLER, THOMAS HUCKLE
USA

In virology, his studies of *varicella* and *herpes zoster* resulted in his isolation for the first time of the viruses responsible for those diseases, and also in the development of diagnostic tests and in the demonstration that, the same virus apparently causes both these diseases.

Note: The 1954 prize was awarded jointly to Enders, Robbins and Weller.

Literature

For his mastery of the art of narrative, most recently demonstrated in 'The Old Man and the Sea', and for the influence that he has exerted on contemporary style.

Hemingway, Ernest Miller, b.—July 21, 1890, Oak Park, Illinois, d.—July 2, 1961, Ketchum, Idaho. A novelist and short story writer who wrote in a virile and extrovert style which masked common aesthetic perception. After graduation from high school he became a reporter for the *Kansas City Star*.

HEMINGWAY, ERNEST MILLER
USA

During World War I he served with the Red Cross and was decorated with the Croce al Merito di guerra. He published *In Our Time* in 1925, a collection of stories and poems, his first book. His reputation as a writer was established with the publication of his novels *The Sun also Rises* (Fiesta, 1926), *Men Without Women* (1927), and *A Farewell to Arms* (1929). He had a special attraction for big-game hunting and bull-fighting. His other works include *Death in the Afternoon* (1932), *The Green Hills of Africa* (1935) and a collection of short stories *To Have or Have Not* (1937).

His reputation was further elevated after he published *For Whom the Bell Tolls* (1940), a true account of the Spanish Civil War. *The Old Man and the Sea* (1952) is one of his finest works, which shows that "man can be defeated, but not destroyed." In his last years, following an airplane crash in 1953, he suffered from mental depression and committed suicide in 1961.

Peace

OFFICE OF THE UNITED NATIONS HIGH COMMISSIONER FOR REFUGEES
Geneva

This year's prize was awarded to an organization, the Office of the United Nations High Commissioner for Refugees. Ever since World War I the refugees provided Europe with a constant problem which was still unsolved when World War II broke out. To solve the problem the allies had set up a special organization in 1943 called the U.N.R.R.A. (United Nations' Relief and Rehabilitation Agency). It assisted those occupied countries with a view to restoring their economic life and assisted in the rehabilitation of many persons displaced by the war. In 1947, a new organization called the International Refugee Organization (IRO) was established by the United Nations. The organization imparted valuable service for rehabilitation of refugees financed by USA and Great Britain. In 1950, the new organization called the office of the United Nations High Commissioner for Refugees came into being. It is a nonpolitical, social and humanitarian body, the principal task of which is to secure the rights of the refugees, to find employments for them, and to assist them with loans.

1955

PHYSICS
Kusch, Polykarp
Lamb Jr., Willis Eugene

CHEMISTRY
Du Vigneaud, Vincent

PHYSIOLOGY OR MEDICINE
Theorell, Axel Hugo Teodor

LITERATURE
Laxness, Halldor Kiljan

1955

Physics

For his precision determination of the magnetic moment of the electron.

Kusch, Polykarp, b.—January 26, 1911, Blankenburg, now in East Germany. A joint winner of the prize with physicist Willis E. Lamb, Jr. for his accurate determination that the magnetic moment of the electron was greater than its theoretical value, thus leading to a reconsideration of and new innovations in nuclear theory.

KUSCH, POLYKARP
Germany/USA

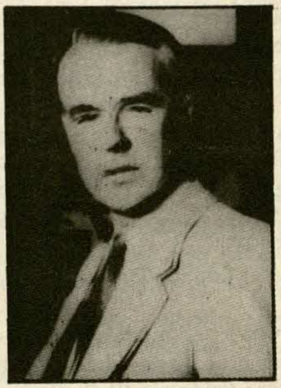
In 1937, Kusch worked with the noted US physicist Isidor I. Rabi (Nobel Laureate) at Columbia University on the first radio-frequency atomic beam experiments, studies of the effects of magnetic fields on beam of atoms. He began working in the Columbia Radiation Laboratory in 1942 and then, after two years, at the Bell Telephone Laboratories. He returned to the Columbia University in 1946 as professor of physics. In the following year Kusch demonstrated conclusively that the magnetic properties of the electron were not in agreement with existing theories through precise atomic beam studies. After which he made definitive measurement of the magnetic field of the electron and its behaviour in hydrogen.

His work was characterized by great accuracy and reliability. Kusch has measured numerous atomic, molecular, and nuclear properties by radio-frequency beam techniques.

◆

For his discoveries concerning the fine structure of the hydrogen spectrum.

Lamb Jr., Willis Eugene, b.—July 12, 1913. Los Angeles. A joint winner of the prize with Polykarp Kusch for experimental work that caused refinements in the quantum theories of electromagnetic phenomena. He joined the faculty of Columbia University and worked in its radiation laboratory during World War II.



LAMB Jr., WILLIS EUGENE
USA

The lines that appear in the spectrum of hydrogen are not simply single dark lines as they appear, but actually are composed of many lines that are extremely close together. This superfine structure was predicted by the quantum mechanics of the noted English physicist Dirac, but Lamb applied new methods to measure the lines and found positions to be slightly different from what had been predicted. This necessitated a revision in the theory to rearrange the facts.

While working as a professor of physics at the Stanford University, he devised microwave techniques for examining the superfine structure of the spectral lines of helium. In 1956, he became professor of theoretical physics at Oxford University and in 1962 was appointed professor of physics at Yale University.

Note: The 1955 prize was awarded jointly to Lamb and Kusch.

Chemistry

For his work on biochemically important sulphur compounds, especially for the first synthesis of a polypeptide hormone.

Du Vigneaud, Vincent, b.—May 18, 1901, Chicago, Illinois, d.—November 12, 1978. He studied at the University of Illinois, from where he took his B.Sc. degree in 1923 and M.Sc. in 1924.

During 1924-25 he was assistant biochemist to Dr. W.G. Forr at the Philadelphia General Hospital and served on the staff of the graduate school of medicine of Pennsylvania University. In 1927 he worked with Professor G.R. Murlin and obtained his Ph.D. from Rochester University, New York. As a Fellow of the National Research Council he worked with Professor J.J. Abet at Johns Hopkins University Medical School, with Professor George Barger at Edinburgh University Medical School and with Professor Charles R. Harrington at London University College Hospital.

On his return to America, Du Vigneaud joined the Physiological Chemical Staff at Illinois University under Professor W.C. Rose. In 1932 he became Head of the Biochemistry Department of the George Washington University Medical School.

He studied the hormone insulin after gaining his Ph.D. in 1927. The research on insulin marked the beginning of his interest in sulfur compounds, particularly the sulfur-containing amino acids—methionine, cystine and cysteine.

DU VIGNEAUD, VINCENT
USA

In 1938 he became head of the biochemistry department of Cornell University Medical College. Two years later he had isolated vitamin H(biotin) and by 1942 had determined its structure. He then went on to examine the hormones secreted by the posterior pituitary gland, especially oxytocin and vasopressin. He found oxytocin to be composed of eight amino acids, worked out the order of these, and in 1954 synthesized artificial oxytocin, which was shown to be as effective as the natural hormone. This was the first protein to be synthesized and for his achievement Du Vigneaud received the Nobel prize for chemistry in 1955.

His other research work included the investigations on penicillin and on methyl groups. From 1967 to 1975 he was professor of chemistry at Cornell University and was its emeritus professor till his death in 1978.

He was awarded the Chandler Medal of Columbia University in 1955, and the Willard Gibbs Medal of the American Chemical Society a year later. Honorary science doctorates were bestowed on him by New York and Yale Universities in 1955, and by Illinois University in 1960. Honorary fellowship have been conferred on him by the Royal Society of Edinburgh, the Chemical Society and the Royal Institute. The Board of Trustees of the Rockefeller Institute also made him a fellow.

Physiology or Medicine

For his discoveries concerning the nature and mode of action of oxidation enzymes.

Theorell, Axel Hugo Teodor, b.—July 6, 1903, Linkoping, Sweden, d.—August 18, 1982. A biochemist whose study of enzymes that facilitate oxidation reactions in living cells helped to create a modern understanding of enzyme action and led to discovery of the ways in which nutrients are utilized by organisms in the presence of oxygen to produce energy.

THEORELL, AXEL HUGO TEODOR
Sweden

He was an assistant professor of biochemistry at Uppsala University and was the first to isolate crystalline myoglobin, an oxygen-carrying protein found in red muscle. At the Kaiser Wilhelm Institute in Berlin, he worked with the German biochemist Otto Warburg (Nobel Laureate) in isolating a pure sample of the "old yellow enzyme" from yeast, which is instrumental in the interconversion of sugars by the cell. Theorell found that the enzyme is composed of two parts; a nonprotein coenzyme, the yellow riboflavine (vitamin B_2) phosphate and a protein apoenzyme. His discovery that the coenzyme actively facilitates oxidation of glucose by binding a hydrogen atom at a specific site on the riboflavine molecule proved for the first time the effect of an enzyme on the chemical activity of specific atoms.

After his appointment as director of the biochemical department of the Nobel Medical Institute in Stockholm, he began to study the oxidative enzyme Cytochrome C, determining the precise nature of the chemical linkage between the iron-bearing, nonprotein porphyrin portion and the apoenzyme. His investigation of the hydrogen-transfer enzyme, alcohol dehydrogenase, led to the development of sensitive blood tests that have found wide application in the legal determination of drunkenness.

Literature

LAXNESS, HALLDOR KILJAN
Iceland

For his vivid epic power, which has renewed the great narrative art of Iceland.

Laxness, Halldor Kiljan, b.—Halldor Gudjoensson, April 23, 1902, Reykjavik, Iceland. He is one of the greatest novelists of the century. He spent his youth in the country, where he gained ideas about the lives and traditions of his poor country people.

His first work, a novel, *Children of Nature*, appeared when he was 17 years old. Then he went abroad and wrote his second novel *Undir Helgarhnuk* (Under the Holy Mountain, 1924). He travelled extensively. While travelling he wrote constantly. In his youth he was an agnostic but later became a Roman Catholic. Some of his works are: *Geroda* (The Happy Wanderer, 1952), *Brekkutotsannall* (1957), *Paradisarheimat* (Paradise Regained, 1960), *Strompleikurinn* (The Chimney Game, 1961), *Prjonastofan Solin* (The Knitting Studio Su, 1962) and *Skaldatimi* (The Hour of the Poets, 1963). Without his literary endeavour the rich cultural heritage of Iceland would have remained in oblivion.

1956

PHYSICS

Bardeen, John / Brattain, Walter Houser
Shockley, William Bradford

CHEMISTRY

Hinshelwood, Sir Cyril Norman
Semenov, Nikolaj Nikolajevič

PHYSIOLOGY OR MEDICINE

Cournand, André Frédéric
Forssmann, Werner
Richards Jr., Dickinson W.

LITERATURE

Jimenez, Juan Ramon

1956

Physics

For their researches on semiconductors and their discovery of the transistor effect.

Bardeen, John, b.—May 23, 1908, Madison, Wisconsin. He won the prize twice—in 1956 and 1972. He shared the 1956 prize with William B. Shockley and Walter H. Brattain for their joint invention of the transistor, and with Leon N. Cooper and John R. Schrieffer he was again awarded the 1972 prize for development of the theory of superconductivity.

BARDEEN, JOHN
USA

Bardeen obtained his Ph.D. in 1936 in mathematics and physics from Princeton University. As a staff member of the University of Minnesota, he served as principal physicist at the US Naval Ordnance Laboratory in Washington, D.C., during World War II. After the war he joined Bell Telephone Laboratories, where he did research on the electron-conducting properties of semiconductors. This work led to the invention of the transistor, which replaced the bulkier vacuum tube in many applications and ushered in the age of microminiature electronic parts.

In 1951, Bardeen joined the staff of the University of Illinois, in Urbana. The theory of superconductivity that is now called BCS theory (from the initials of Bardeen, Cooper and Schrieffer) was first advanced in 1957; all later theoretical work in superconductivity is based upon it. Bardeen was also the author of a theory explaining certain properties of semiconductors. ◆

For their researches on semiconductors and their discovery of the transistor effect.

Brattain, Walter Houser, b.—February 10, 1902, Amoy, China. A winner of the prize, with John Bardeen and William B. Shockley, for his investigation of the properties of semiconductors. Transistors were developed on the basis of his investigations. The transistor replaced the bulkier vacuum tube for many uses and was the forerunner of microminiature electronics.

BRATTAIN, WALTER HOUSER
USA

In 1929, Brattain became a research physicist for Bell Telephone Laboratories. His chief field of research involved investigations into the surface properties of solids, particularly the atomic structure of material at the surface, which differs usually from its atomic structure in the interior. He became adjunct professor at Whitman College, Walla Walla, Washington. He has been granted a number of patents and has written extensively on solid-state physics. ◆

For their researches on semiconductors and their discovery of the transistor effect.

Shockley, William Bradford, b.—February 13, 1910, London. Shockley joined the technical staff of the Bell Telephone Laboratories in 1936 and there began experiments that led to his invention and development of the junction transistor. During World War II, he served as director of research for the Antisubmarine Warfare Operations Research Group of the US Navy. After the war, he returned to Bell Telephone as director of transistor physics research. He was visiting professor of physics at the California Institute of Technology and deputy director of the Weapons Systems Evaluation Group of the Department of Defense; he joined Beckman Instruments, to establish the Shockley Semiconductor Laboratory. In 1958, he became lecturer at Stanford University, and in 1963 he became the first Poniatoff professor of engineering science at Stanford University.

SHOCKLEY, WILLIAM
USA

Note: The 1956 prize was awarded jointly to Shockley, Bardeen and Brattain.

Chemistry

For their researches into the mechanism of chemical reactions.

Hinshelwood, Sir Cyril Norman, b.—June 19, 1887, London, d.—October 9, 1967, London. Hinshelwood was the only son of a chartered accountant. His father died in 1904 and his mother settled in Chelsea where she and Hinshelwood lived for the rest of their lives. His mother died in 1959.

He was educated in London at Westminster City School. His studies were interrupted by World War I. In 1916 he joined as a chemist in the Explosives Supply Factory, and stayed there till 1919. After the war he won a scholarship to Balliol College, Oxford, where he was elected a Fellow immediately on graduation in 1920. He was a tutorial Fellow of Trinity College, Oxford, during 1921-37. In 1937 he was appointed Dr. Lee's Professor of Physical and Inorganic Chemistry in the University of Oxford, a post he held until his retirement in 1964. After retirement he was made a Senior Research Fellow at Imperial College, London, a post he retained till his death in 1967.

Hinshelwood's first book, *Kinetics of Chemical Change in Gaseous Systems* (1926), was based upon five years of intensive research.

His other books are: *Chemical Kinetics of the Bacterial Cell* (1946) and *Growth, Function and Regulation in Bacterial Cells* (1966).

He worked mainly in the field of chemical reaction kinetics. He came very close to the true meaning of DNA, established by Jim Watson and Francis Crick in 1953. He declared that in the synthesis of protein the nucleic acid guides the order in which the various amino acids are laid down. Little attention was paid to Hinshelwood's proposal at the time although Crick later declared it to be the first serious suggestion of how DNA might work.

Hinshelwood's scientific work was internationally recognized. He became a Fellow of the Royal Society in 1929 and was its President from 1955 to 1960. He was also President of the Chemical Society during 1946-48. He was knighted in 1948 and elected to the Order of Merit in 1960.

Apart from his achievements as a scientist, Hinshelwood was a brilliant linguist, proficient in French, German, Italian, Spanish, Russian and Chinese. He was a keen collector of Chinese porcelain and Eastern carpets and a gifted painter

HINSHELWOOD, Sir CYRIL NORMAN
Great Britain

He had the distinction of being simultaneously President of the Classical Association and of the Royal Society. His approach to sciences was philosophic as well as practical, as exemplified in his *Structure of Physical Chemistry* (1951).

He never married. ◇

For their researches into the mechanism of chemical reactions.

Semenov, Nikolaj Nikolajevic, b.—1896. A Russian physical chemist who shared the prize with Sir Cyril Hinshelwood for research in chemical kinetics, specially in respect of chain and brandchained chemical reactions. He was associated with the A.F. Ioff Physical Technical Institute of Leningrad (1920-30) and became a professor in 1928. Later he became the director of the Institute of Chemical Physics at the Soviet Academy of Sciences of Moscow.

SEMENOV, NIKOLAJ NIKOLAJEVIĆ
USSR

He is the first Soviet citizen to receive a Nobel prize. He published an important book named *Chemical Kinetics and Chain Reactions* (1934), which was translated into English in 1935.

Note: The 1956 prize was awarded jointly to Hinshelwood and Semenov.

Physiology or Medicine

For their discoveries concerning heart catheterization and pathological changes in the circulatory system.

Cournand, André Frédéric, b.—September 24, 1895, Paris. A physician and physiologist who shared the prize with Dickinson W. Richards and Werner Forssmann for research that led to a better understanding of heart diseases. After graduating in medicine from the University of Paris in 1930, Cournand studied at Bellevue Hospital, New York City. There he met Richards, with whom he collaborated in respiratory and cardiac research. Through their perfection of Forssmann's cardiac catheterization technique, it became possible to study the conditions under which the diseased human heart functions and to make more

COURNAND, ANDRÉ FRÉDÉRIC
France/USA

accurate diagnoses of the underlying structural defects of the heart.

Cournand became an instructor at the College of Physicians and Surgeons of Columbia University in 1934 and held the rank of professor after 1951. He became a naturalized citizen of the USA in 1941. ◆

For their discoveries concerning heart catheterization and pathological changes in the circulatory system.

Forssmann, Werner, b.—August 29, 1904, Berlin, d.—June 1, 1979, Schopfheim. He was educated at the *Askanische Gymnasium* (secondary grammar school) in Berlin. In 1922, he went to the University of Berlin to study medicine, passing his State Examination in 1929. For clinical instruction in surgery he went in 1929 to the August Victoria Home at Eberswalde near Berlin.

FORSSMANN, WERNER
Germany

It was here that he developed a technique for the catheterization of the heart. This he did by inserting a cannula into his own antecubital vein, through which he passed a catheter for 65 cm. and then walked to the X-ray department, where a photograph of the catheter was taken, which was lying in his right atrium!

Forssmann catheterized his own heart nine times until he had no more available patent superficial veins. He asked Professor Ferdinand Sauerbruch of Berlin, who was the world's leading thoracic surgeon, to see whether any use could be made of this new technique of cardiac catheterization, either for therapeutic or diagnostic purposes. Professor Sauerbruch's reaction was that, "he ran a clinic for patients, not a circus." Forssmann was barred from any further important hospital appointments and had difficulty in obtaining suitable work. Twenty years later he was discovered working as general practitioner in a small town in the Rhine Valley. Fortunately, Forssmann's originality and personal heroism achieved international recognition when he was awarded the prize.

From 1950 onwards he practised as an urologist at Bad Kreuznach, and since 1958 he has been Chief of the Surgical Division of the Evangelical Hospital at Duesseldorf. In 1954, he was awarded the Leibniz Medal of the German Academy of Sciences, in the same year he was Guest of Honour at the National University of Cordoba, Argentina, where he was appointed Honorary Professor in 1961. In the same year he was appointed as Honorary Professor of Surgery and Urology at the Johannes Gutenberg University, Mainz. ◆

For their discoveries concerning heart catheterization and pathological changes in the circulatory system.

Richards Jr., Dickinson W., b.—October 30, 1895, Orange, New Jersey, d.—February 23, 1973, Lakeville, Connecticut. A physiologist who shared the prize with Forssmann and Cournand. Cournand and Richards adapted Forssmann's technique of using a flexible catheter, introduced into an elbow vein and guided to the heart, as a probe to investigate the living human heart.

RICHARDS Jr., DICKINSON W
USA

After study in England, Richards began his research at the College of Physicians and Surgeons, Columbia University, in 1928. He taught there from 1947 to 1961 and became Emeritus professor thereafter. From 1945 to 1961 he directed the Columbia medical division at the Bellevue Hospital, New York, where he met Cournand. Their use and perfection of Forssmann's method, known as "Cardiac catheterization", permitted them to measure blood pressure and gaseous conditions of the blood inside the living heart.

Note: The 1956 prize was awarded jointly to Cournand, Forssmann and Richards.

Literature

For his lyrical poetry, which in Spanish language constitutes an example of high spirit and artistical purity.

Jimenez, Juan Ramon, b.—December 24, 1881, Moguer, Spain, d.—May 29, 1958, San Juan, Puerto Rico. A poet, who studied briefly at the University of Salamanca, then went to Madrid in 1900 at the invitation of the poet Ruben Dario.

His first two volumes of poetry came out in the same year; those were *Almas de violeta* (Sound of Violet, 1900) and *Ninfeas* (Water Lillies), followed by *Arias tristers* (Sad Arias, 1903) Because of ill health he left Madrid. His publications such as *Pastorales* (1914), *Jardines Lejanos* (1904, Distant Gardens) and *Elegias* (1908, Elegies) clearly reflected the influence of Ruben Dario. He returned to Madrid in 1912 and lived there up to 1916. He went to America in 1916 and married Zenobia Camprubi, the Spanish translator of the works of Nobel Laureate Bengali poet Rabindranath Tagore (1913). After returning to Spain he published *Diario de un poetra recien casado* (1917, Diary of a poet, recently married), which was issued in 1948 as *Diaria de un poeta y mar* (Diary of poet and the sea).

JIMENEZ, JUAN RAMON
Spain

During the Spanish Civil War he went on voluntary exile to Puerto Rico, where he spent most of his later life. Among his better known poems are *Sonetos espirituales* (1915, Spiritual Sonnets, 1915) *Eternidades* (Eternities, 1918), *Piedra Y cielo* (1919, Stones and Sky), *Belleza* (Beauty, 1923), *Poesia en verso* (1917-23, Poems and Verses, 1929), *Poesia en proso y verso*(1932, Poetry in Prose and Verse), *Voces de mi copla* (1945, Voice of my Song) and *Animal de fondo* (Animal of Depth, 1949).

1957

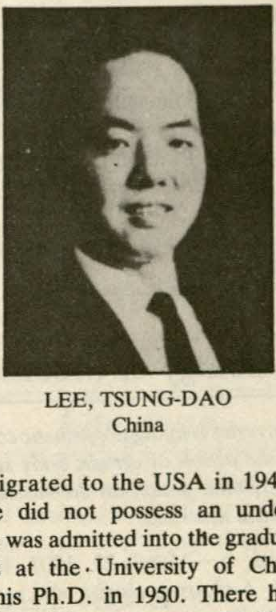
PHYSICS
Lee, Tsung-Dao / Yang, Chen Ning
CHEMISTRY
Todd, Lord Alexander R.
PHYSIOLOGY OR MEDICINE
Bovet, Daniel
LITERATURE
Camus, Albert
PEACE
Pearson, Lester Bowles

1957

Physics

For their penetrating investigation of the so-called parity laws which has led to important discoveries regarding the elementary particles.

Lee, Tsung-Dao, b.—November 25, 1926, Shanghai. A physicist who, with Chen Ning Yang, received the prize for their work in discovering violations of the principle for parity conservation, thus bringing about major improvements in particle physics theory.



LEE, TSUNG-DAO
China

Lee emigrated to the USA in 1946 and, although he did not possess an undergraduate degree, he was admitted into the graduate school in physics at the University of Chicago and obtained his Ph.D. in 1950. There he had the collaboration of Yang on research which brought forth fundamental contributions in many aspects of theoretical physics. After serving briefly in the physics department of the University of California, he joined Yang at the Institute for Advanced Study, Princeton, New Jersey. Later he was appointed assistant professor of physics at Columbia University. During the early 50s he and Yang studied theta- and tau-meson decay, which are weak particle interactions that have identical characteristics, except for their decay mode. The theta-meson decays to form three "pions" and the tau-meson to two "pions". He and Yang concluded that the theta-mesons and tau-mesons are in fact the same particle. Because the law of parity conservation prohibits the same particle from having decay modes exhibiting opposite parity, the only possible conclusion was that for weak interactions, at least, parity is not conserved. They suggested experiments to test their hypothesis, and in 1957 the American physicist Chien-Shiung Wu, working at Columbia University, experimentally confirmed their theoretical conclusions.

In 1960, Lee was appointed professor of physics at the Institute for Advanced Study, and three years later he returned to Columbia to assume the first Enrico Fermi professorship in physics.

For their penetrating investigation of the so-called parity laws which has led to important discoveries regarding the elementary particles.

Yang, Chen Ning, b.—September 22, 1922, Hofei, Anhwei, China. A theoretical physicist whose study of parity conservation with Taung-Dao Lee showed that there could be violations of what had been regarded as a fundamental principle previously considered generally valid. Substantial advances in particle physics followed. He received his bachelor's and master's degrees from Southwest Associated University in Kunming and his doctorate from the University of Chicago in 1948 under Fermi. In 1949, Yang went to the Institute for Advanced Study in Princeton, New Jersey, and became a professor there. From 1965, he held the Albert Einstein Chair of Physics at the State University of New York at Stony Brook,

YANG, CHEN NING
China

Long Island. Yang and his collaborator, Tsung-Dao Lee, showed in 1956, that there can be parity violation. His other researches include statistics and elementary particle theory.

Note: The 1957 prize was awarded jointly to Lee and Yang.

Chemistry

For his work on nucleotides and nucleotide co-enzymes.

Todd, Lord Alexander R., b.—October 2, 1907, Glasgow. He was educated at Allan Glen's School and Glasgow University, from where he took his B.Sc. degree in 1928. He received doctorates from the University of Frankfurt in 1931, and from Oxford University in 1933.

Todd went to Scotland in 1934 and joined the Edinburgh University. In 1936, he joined the Lister Institute of Preventive Medicine, London. He became Reader in Biochemistry at the University of London in 1937. In 1938, he was appointed Sir Samuel Hall Professor of Chemistry and Director of the Chemical Laboratories of the University of Manchester. He was appointed Professor of Organic Chemistry at Cambridge University in 1944.

Todd is married to Alison Sarah, daughter of Sir Henry Dale, Nobel Laureate in Medicine, 1936; they have one son and two daughters.

Besides his work on nucleotides, nucleotide co-enzymes, Todd in 1955 determined the structure of Vitamin B. He also worked on the structure of Vitamin E.

TODD, Lord ALEXANDER R.
Great Britain

Todd holds honorary doctorates from several universities. He is a fellow of the Royal Society and has won many medals including the Royal Medal of the Royal Society.

Todd has served on many Government Committees. In 1952, he was elected Chairman of the British Government's Advisory Council on Scientific Policy. He is a Managing Trustee of the Nuffield Foundation. He is the President of the International Union of Pure and Applied Chemistry and Chairman of the British National Committee for Chemistry.

Todd was knighted in 1954, and made a life peer in 1962.

Physiology or Medicine

For his discoveries relating to synthetic compounds that inhibit the action of certain body substances, and especially their action on the vascular system and the skeletal muscles.

Bovet, Daniel, b.—March 23, 1907, Neuchâtel, Switzerland. A pharmacologist who received the prize for his discoveries of certain chemotherapeutic agents.

In 1944 he discovered *pyrilamine* (mepyramine), the first antihistaminic, which counteracts the effect of histamine and is effective against allergic conditions. In 1947, his search for a synthetic substitute for curare (a poison used by South American Indians on arrow tips) led to the discovery of *gallamine* and other muscle relaxants. Among these are derivatives of succinylcholine, whose curare-like action in conjunction with light anaesthesia induces muscular relaxation during major surgery.

BOVET, DANIEL
Italy

Bovet studied in Geneva, graduating with a doctor of science degree in 1929. He went to the Pasteur Institute in Paris and became head of the therapeutic chemistry laboratory in 1937. Ten years later he was invited to establish a laboratory of chemotherapeutics at the Instituto Superiore de Sanita in Rome. He was professor of pharmacology at the University of Sassari, Italy. He was also visiting professor of physiology at the University of California School of Medicine at Los Angeles.

Literature

For his important literary production, which with clearsighted earnestness illuminates the problems of the human conscience in our times.

Camus, Albert, b.—November 7, 1913, Mondovi, Algeria, d.—January 4, 1960, near Sens, France. A moralist, novelist, playwright and political theorist. He formulated the outlines of a new kind of liberal humanism. He was brought up in a poor working class environment of Algiers. He was educated in philosophy at the University of Algiers.

He engaged himself for some time in left-wing politics and workers' theatrical movement. He took up journalism in the thirties. He edited a clandestine newspaper called the *Combat* during the German occupation of Algeria, later the newspaper became a Parisian left-wing newspaper. His best novels are *L' Etranger* (1942, The Stranger, 1946), *La Peste* (1947, The Plague, 1948) and *La chute* (1956, The Fall, 1957). He wrote many plays. He published two major philosophical essays, *Le Mythe de Sysyphe* (1942, The Myth of Sysyphus, 1955) and *L'Homme revolte* (1951, The Rebel, 1953). He lost his life in a motor car accident in 1960.

CAMUS, ALBERT
France

Peace

PEARSON, LESTER BOWLES
Canada

Pearson, Lester Bowles, b.—April 23, 1897, Toronto, d.—December 27, 1972 Ottawa. A Canadian politician, diplomat and Prime Minister of Canada who was prominent as a mediator of peace in international disputes during 1963-68. He was awarded the prize for successful peace mediation during the Suez Canal crisis in 1956. He served in World War I and was a lecturer in history in Oxford and Toronto Universities (1924-28). He joined the Canadian Foreign Service in 1928 and became first secretary in the Department of External Affairs. He served on two Royal commissions, in 1931 and 1935. In 1945, he became the Canadian Ambassador to the USA and served until 1948. In 1947, he became the Chairman of the Political and Security Committee of the UN General Assembly. During this tenure he helped to achieve the Palestinian partition resolution. In 1951, he became the Chairman of the N.A.T.O. In 1963, he became the Prime Minister of Canada, and resigned from the post in 1968 and totally retired from politics.

1958

PHYSICS

Ĉerenkov, Pavel Aleksejvic
Frank, Il'Ja Michajlovic
Tamm, Igor Jevgen'evic

CHEMISTRY

Sanger, Frederick

PHYSIOLOGY OR MEDICINE

Beadle, George Wells / Tatum, Edward Lawrie
Lederberg, Joshua

LITERATURE

Pasternak, Boris Leonidovic

PEACE

Pire, Georges

1958

Physics

For the discovery and the interpretation of the Cerenkov effect.

Ĉerenkov, Pavel Aleksejvic, b.—July 15, 1904, Voronezh, Russia. He discovered that light waves are emitted from a charged particle when it travels through some transparent material with a velocity greater than the velocity of light in that same material. The phenomenon is now called the "Cerenkov effect" and is used extensively in high-energy physics to detect charged particles and measure their velocity. Ĉerenkov graduated from the University of Voronezh in 1928. He discovered the Cerenkov effect in 1934. He was a research student at the Institute of Physics of the Academy of Sciences of the USSR where he later became a Professor. ◆

ĈERENKOV, PAVEL ALEKSEJVIĈ
USSR

For the discovery and the interpretation of the Cerenkov effect.

Frank, Il'ja Michajlovic, b.—October 23, 1908, Leningrad. In 1934, Ĉerenkov discovered that light is emitted by charged particles travelling at very high speeds. This discovery resulted in the development of new methods for detecting and measuring the velocity of high-speed particles and became of great importance for research in nuclear physics. Frank and Tamm provided the theoretical interpretation of this effect. Frank's work also includes collaboration with Ĉerenkov and Tamm in research on electron radiation, for which each was awarded the Stalin Prize. Frank also specialized in the study of gamma rays and neutron beams. He became head of the department of physics at the University of Moscow and was made a member of the Academy of Sciences of the USSR in 1946. ◆

FRANK, IL'JA MICHAJLOVIĈ
USSR

For the discovery and the interpretation of the Cerenkov effect.

Tamm, Igor Jevgen'evic, b.—July 8, 1895, Vladivostok, in Russia, d.—April 12, 1971, Moscow.

TAMM, IGOR JEVGEN'EVIĈ
USSR

A Professor at Moscow University, he studied the quantum theory of diffused light in solid bodies before he worked with Frank in deriving the theory of the Ĉerenkov radiation. His technique of interpreting the interaction of elementary nuclear particles is known as the "Tamm method". Interest in the peaceful uses of nuclear energy led him to work on method for the control of thermonuclear reactions. He favoured an international disarmament for peace.

Note: The 1958 prize was awarded jointly to Cerenkov, Frank and Tamm.

Chemistry

For his work on the structure of proteins, especially that of insulin.

Sanger, Frederick, b.—August 13, 1918, Rendcombe, England. He received his B.A. in 1939 and Ph.D. in 1943 from Cambridge University. He continued his research at the University until 1951 with a Beit Memorial Fellowship for Medical Research, and since 1951 he has been a member of the external staff of the Medical Research Council. He is at present Head of the Division of Protein Chemistry in the M.R.C. Laboratory for Molecular Biology, Cambridge.

In 1940 he married Margaret Joan Howe; they have two sons and one daughter.

Since 1943 Sanger has been working on the problems related to the determination of the structure of proteins. He developed a technique by means of which he could "mark" the amino acid at the end of a chain. Sanger thus isolated the coloured components, which must represent terminal groups, from the complicated mixture of amino acids which results when insulin, "marked" in this fashion, is boiled with acids. He demonstrated that the insulin molecule contains two different chains with different end-groups, and isolated them after breaking the molecule by oxidation. Instead of one molecule with 51 amino acids, he now had two with 31 and 20 amino acids respectively. He showed that these two chains are held together with the aid of two bridges of sulphur atoms. He thus established the structure of insulin which is a protein.

In 1977 Sanger and his team of M.R.C. laboratories, Cambridge, published the complete nucleotide base sequence of the genetic material DNA of the virus Phi X 174. This involved determining about 5400 nucleotides along the single circular DNA strand. Moreover, they found two cases of genes located within genes. Prior to this work it had been thought that genes could not overlap. Sanger's research required the development of new techniques for splitting the DNA into different sized fragments. These were radioactively labelled and then separated by electrophoresis. The base sequence was then worked, because it is known which base is located at the end of each fragment due to the specificity of the enzymes (the so-called restriction enzymes) used to split the DNA.

SANGER, FREDERICK
Great Britain

Sanger received his first Nobel Prize for Chemistry in 1958 for finding out the complete amino acid sequence of the protein bovine insulin. He received his second Nobel Prize also in chemistry in 1980 for his work in determining the base sequences of nucleic acid. John Bardeen is the only other scientist who also received the Nobel Prize for physics twice (1956 and 1972).

In 1951 he received the Corday-Morgan Medal and Prize of the Chemical Society. In 1954 he became a Fellow of the Royal Society and a Fellow of King's College, Cambridge. He is an Honorary Foreign Member of the American Academy of Arts and Sciences and Honorary Member of the American Society of Biological Chemists.

Physiology or Medicine

For their discovery that genes act by regulating definite chemical events.

Beadle, George Wells, b.—October 22, 1903, Wahoo, Nebraska. A geneticist and the sixth President of the University of Chicago, who helped to establish biochemical genetics when he showed that genes affect heredity by determining enzyme structure. His father was a farmer. After earning his Ph.D. in genetics from Cornell University, Ithaca, New York (1931) he went to the laboratory of Thomas Hunt Morgan (Nobel Laureate) at the California Institute of Technology, where he did further work on the fruit fly, *Drosophila melanogaster*, Morgan had developed study of the fruit fly into one of the most promising tools in genetics research. Beadle soon realized that genes, distinct points on the chromosome, must influence heredity chemically. In 1935, with Boris Ephrussi at the Institut de Biologie Physico-Chimique in Paris, he designed a complex technique to determine the nature of these chemical effects in *Drosophila.* Their results indicated that something as apparently simple as eye colour is the product of a long series of chemical reactions and that genes somehow affect these reactions.

BEADLE, GEORGE WELLS
USA

After a year at Harvard, where he had taught genetics, Beadle pursued the study of gene action in detail at Stanford University. Working there with Edward Tatum (Nobel Laureate) he found that the total environment of a red bread mold, *Neurospora*, could be varied in such a way that the researches could locate and identify genetic changes, or "mutants" with comparative ease. They exposed the mold to X-rays and studied the altered nourishing requirements of the mutants thus produced. These experiments enabled them to conclude that each determined the structure of a specific enzyme which in turn, allowed a single chemical reaction to proceed. This "one gene one enzyme" concept won Beadle, Tatum and Joshua Lederberg the 1958 Nobel Prize for Physiology or Medicine. Further, the use of genetics to study the biochemistry of micro-organisms, outlined in the outstanding paper *Genetic Control of Biochemical Reactions in Neurospora* (1941), by Beadle and Tatum, opened up a new field with far-reaching implications in the field of cancer research.

◆

For their discovery that genes act by regulating definite chemical events.

Tatum, Edward Lawrie, b.—December 14, 1909, Boulder, Colorado, d.—November 5, 1975, New York City. He was the eldest son of Arthur Lawrie Tatum, Professor of Pharmacology at the Wisconsin Medical School, and Mabel Webb Tatum. He was educated at the University of Chicago and Wisconsin, taking his M.S. in microbiology in 1932 and Ph.D. in chemistry in 1934. His doctoral thesis on the nutrition and metabolism bacteria done under the supervision of Edwin Brann Fred and William Harold Peterson laid the foundations of his later work with George Wells Beadle. A biochemist whose fundamental research on the way in which inherited mutations affect the nutritional requirements of certain species of bacteria, yeasts, and molds helped to create the field of molecular genetics.

As a research associate at Stanford University, Palo Alto, California, he collaborated with Beadle to confirm the following concepts that all biochemical processes in all organisms are ultimately controlled by genes; all these processes are resolvable into series of individual sequential chemical reactions and each reaction is in some way controlled by a single gene; a mutation of a single gene results only in an alteration in the ability of the cell to carry out a single chemical reaction. Initially he commenced his genetic research on *Drosophila melanogaster* but with the suggestion of Beadle gave up their work on *Drosophila* and decided to work with the fungus *Neurospora crassa.*

TATUM, EDWARD LAWRIE
USA

Working with the red bread mold *Neurospora crassa,* Tatum and his colleagues established that, when a genetic mutation can be shown to affect a specific chemical reaction, the enzyme catalyzing that reaction will be altered or missing. Thus, they demonstrated that each gene in some way determines the structure of a specific enzyme and created the modern concept of biochemical genetics.

◆

For their discoveries concerning genetic recombination and the organization of the genetic material of bacteria.

Lederberg, Joshua, b.—May 23, 1925, Montclair, New Jersey. Brought up in the Washington Heights District of Upper Manhattan, New York City, he obtained his B.A. with honours in Zoology from Columbia College in 1944. He obtained his Ph.D. in 1948. In 1947 he was appointed Assistant Professor of Genetics at the University of Wisconsin, where he rose to become the professor in 1954. He joined Stanford University Medical School in 1959 as the Professor and Executive Head of the Department of Genetics in 1959. Lederberg married Esther M. Zimmer, while at Yale in 1946 and they have no children. A geneticist and pioneer in the field of bacterial genetics. He shared the prize with George W. Beadle and Edward L. Tatum for discovering the organization of genetic material and mechanisms of recombination in bacteria.

With Tatum he published *Gene Recombination in Escherichia coli* (1946), in which he reported that genetic information is passed from one bacterium to another in an orderly fashion. While biologists, who had not previously thought that "sex" existed in bacteria such as *E. coli*, were still confirming Lederberg's discovery, he and his student Zinder reported another, equally surprising, finding. In the paper *Genetic Exchange in Salmonella* (1952), they revealed that certain viruses were capable of carrying part of a bacterial chromosome from one bacterium to another, a phenomenon they termed "transduction". Lederberg's discoveries made bacteria a tool of genetic research as important as the fruit fly *Drosophila* and the bread mold *Neurospora crassa.*

LEDERBERG, JOSHUA
USA

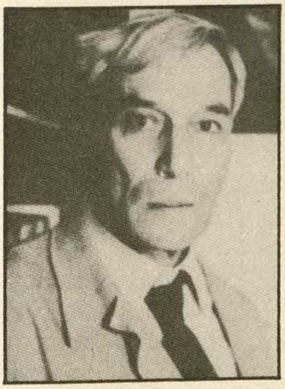
He not only developed ingenious techniques in bacterial genetics but also devised methods of identifying and classifying organic chemicals by computer and mathematical graph theory and statistical methods of studying human biology by using American census data. From 1959, Lederberg was professor of genetics and biology and Chairman of the genetics department at Stanford Medical School, and from 1962 director of the Kennedy Laboratories of Molecular Medicine.

Note: The 1958 prize was awarded jointly one half to Beadle and Tatum and the other half to Lederberg.

Literature

For his important achievement both in contemporary lyrical poetry and in the field of the great Russian epic tradition.

Pasternak, Boris Leonidovic, b.—February 10, 1890, Moscow, d.—May 30, 1960, Peredelinko, near Moscow. A poet whose novel *Doctor Zhivago* made him famous all over the world and aroused vehement opposition in the Soviet Union. The novel is an epic of spiritual isolation and love amidst the harshness of the Bolshevik revolution and its aftermath. It was circulated in secrecy in the Soviet Union and was translated into English by the author himself; it was later translated into 18 languages.



PASTERNAK, BORIS LEONIDOVIC
USSR

Boris was brought up in a cultured Jewish family; his father was a professor of art and an artist. He planned for a musical career but instead became a poet early in life. He initially studied musicology, then philosophy at the Moscow and Marburg Universities. He was physically disqualified for military services and hence worked in a chemical plant in the Urals during World War I. After the Soviet revolution, he worked in the library of the Soviet Commissariat of Education.

In 1917, he brought out a volume of poems, *Poverkh baryerov* (Over the Barriers), which was followed by *Sestra moya Zhizn* (My Sister Life, 1922), *Temy i variasu* (Themes and Variations, 1923), *Vysokaya bolezn* (Sublime Malady, 1924), and *Detstvo Lyuvers* (The Childhood of Lovers, 1924). A collection of four short-stories under the title *Vozdushnye puti* (Aerial Ways) came out in 1925. In 1931, his autobiography *Okhrannaya granota* (Safe Conduct) appeared, which was followed by a collection of lyrics *Vtoroye rozhdenie* (Second Birth, 1932).

From 1933 to 1943 the difference between his concepts and the official ideas became too wide to permit him to publish his works, and he became apprehensive of his personal safety. *Na rannikh poyezdakh* (In early trains, poems since 1936) was published in 1943 and reissued in 1945 as *Zemnye prostory* (Widespaces of the Earth). Strangely enough Stalin spared him, possibly because of his successful translation of some popular Georgian poets; Stalin was a Georgian. But he was not allowed to accept the prize. He spent his last years in dire poverty and anguish in his home at Peredelinko as he thought that leaving his motherland would mean death for him.

Peace

Pire, Georges, b.—1910, Dinant, Belgium, During World War I his family lived as refugees in France. In 1927, Pire graduated, and was admitted to the Dominican monastery of La Sarté Huy near Liegé. After studying in Rome, he was ordained in 1934, and took his doctorate in 1936. Between 1937 and 1947, he lectured on moral philosophy and sociology in the monastery.

During World War II he took an active part in the resistance movement, both as a military chaplain and as an intelligence agent, receiving the War Cross and the Resistance Medal for his service. He furthermore did social work, including the setting-up of a children's camp which also cared for several hundred French youngsters during the immediate post-war period.

Father Pire's work for refugees commenced in 1949, after he had been inspired to devote himself

PIRE, GEORGES
Belgium

to this task by a lecture on the problems of refugee camps delivered by an American U.N.R.R.A. official. Father Pire's activities from that moment onwards may be grouped under three headings. The first was the so-called *'service de parrainage'* (sponsorship service), where inmates of refugee camps were put in touch with outside "sponsors", the idea being to give them a new interest in life through the medium of personal contact beyond the precincts of their camp. The second form of aid which he organized was the setting-up of homes for elderly refugees, who were incapable of fending for themselves. The third project was initiated as the establishment of "European Villages", starting in 1956. The first of these is situated at Aachen (Aix-la-Chapelle) in Germany, the second at Bregenz in Austria, and the third at Augsburg in Germany. A fourth, named after Fridtjof Nansen, was started in 1958 at Berchem-ste-Agathe near Brussels. Each of these "villages" consisted of 12 houses, each containing 2 flats. Half the rent is paid by the occupants, and the other half by charity.

The basis of father Pire's activity is the organization *Aide aux personnes deplaces et ses village europeens*. He has also instituted an association consisting of his closest co-workers, which he had named *L'Europe du Coeur au service du monde*.

1959

PHYSICS
Chamberlain, Owen / Segre, Emilio Gino

CHEMISTRY
Heyrovsky, Jaroslav

PHYSIOLOGY OR MEDICINE
Kornberg, Arthur / Ochoa, Severo

LITERATURE
Quasimodo, Salvatore

PEACE
Noel-Baker, Philip J.

1959

Physics

For their discovery of the antiproton.

Chamberlain, Owen, b.—July 10, 1920, San Francisco. A joint winner with Emillio Segré of the prize for their discovery of the antiproton. The previously postulated subatomic particle was the second antiparticle to be discovered and led directly to the discovery of many additional antiparticles.

CHAMBERLAIN, OWEN
USA

Chamberlain worked on the US atom bomb project during World War II. Later, while working for his Ph.D. at the University of Chicago, he worked at Argonne National Laboratory, in Illinois. In 1948, he joined the faculty of the University of California at Berkeley, where he did research on alpha particle decay, neutron diffraction in liquids, and high energy nuclear particles reactions. He and Segre used the bevatron particle accelerator to produce antiprotons in 1955, and the following year they confirmed the existence of the "antineutron". Bevatron particle accelerators are now being used for irradiating cancer in humans.

For their discovery of the antiproton.

Segre, Emilio Gino, b.—February 1, 1905, Tivoli, Italy. Segre obtained his Ph.D. under Fermi from the University of Rome in 1928. In 1932, he was appointed assistant professor of physics at the University of Rome, and two years later he participated in neutron experiments directed by the noted physicist Enrico Fermi, in which many elements, including uranium, were bombarded with neutrons, and transuranic elements were created. In 1935 they discovered slow neutrons, which have properties facilitating the operation of nuclear reactors. But it remained for others to discover nuclear fission four years later. Segre left Rome in 1936 to become director of the physics laboratory at the University of Palermo in Sicily. One year later he discovered "technetium", the first man-made element not found in nature. While visiting California in 1938, Segre was dismissed from the University of Palermo by the Fascist Government, so he remained in the USA as a research associate at the University of California at Berkeley and became a citizen in 1944. Continuing his research, he and his associates discovered the element "astatine" in 1940, and later, with another group of scientists he discovered

SEGRE, EMILIO GINO
Italy/USA

"plutonium-239", which is similarly fissionable like "uranium-235". Plutonium-239 was used in the first atomic bomb and in the bomb dropped on Nagasaki. He became a professor of physics at Berkeley in 1955. Segre and Chamberlain succeeded in producing and identifying antiprotons with the help of bevatron particle accelerator. He published a book entitled *Nuclei and Particles* in 1964.

Note: The 1959 prize was awarded jointly to Chamberlain and Segre.

Chemistry

For his discovery and development of the polarographic methods of analysis.

Heyrovsky, Jaroslav, b.—December 20, 1890, Prague, d.—March 27, 1967, Prague. A chemist who won the prize for his discovery and development of polarography, an instrumental method of chemical analysis used for qualitative and quantitative determinations which was almost impossible to be made by other means. His polarograph measures the current that flows when a predetermined potential is applied to two electrodes immersed in the solution to be analyzed.

HEYROVSKY, JAROSLAV
Czechoslovakia

He was educated at the Charles University of Prague and at University College, London, where he worked under Sir William Ramsay (Nobel Laureate) and F.G. Donnan. After holding several posts at the Charles University, he became professor and director of the department of physical chemistry, and he was appointed director of the Polarography Institute at the Czechoslovak Academy of Sciences. The work which eventually led him to the discovery of polarography was started in London at Donnan's suggestion. Ten years elapsed between the first polarography taken in 1924 and the common use of the method. Heyrovsky's monograph, *Polarographie*, was published in 1941.

Physiology or Medicine

For their discovery of the mechanisms in the biological synthesis of ribonucleic acid and deoxyribonucleic acid.

Kornberg, Arthur, b.—March 3, 1918, Brooklyn, New York. A physician and biochemist who received with Severo Ochoa the prize for discovering the means by which deoxyribonucleic acid (DNA) molecules are duplicated in the bacterial cell, as well as the means for reconstructing this duplication process *in vitro*.

KORNBERG, ARTHUR
USA

At the US National Institute of Health, Bethesda, Maryland (1942-53), he directed research on enzymes and intermediary metabolism. He also helped to discover the chemical reactions in the cell that result in the construction of *flavine adenine dinucleotide* (FAD) and *diphosphopyridine nucleotide* (DPN), which are coenzymes that serve as important hydrogen carrying intermediaries in biological oxidations and reductions. He was appointed professor and director of the microbiology department at Washington University, St. Louis, Missourie (1953-59). He continued to study the way in which living organisms manufacture nucleotides, the building blocks for the giant nucleic acids DNA and RNA.

This research led Kornberg directly to the problem of how nucleotides are strung together to form DNA molecules. Adding nucleotides labeled with radioactive isotopes to extracts prepared from cultures of the common intestinal micro organism *Escherichia coli*, he found (1956) the evidence of an enzyme catalyzed polymerization reaction. He isolated and purified the enzyme. Kornberg wrote *Enzymatic Synthesis of DNA* (1961) and has served as Chairman of the biochemistry department at Stanford University, Palo Alto, California, since 1959. ◆

For his discoveries concerning genetic recombination and the organization of the genetic material of bacteria.

Ochoa, Severo, b.—September 24, 1905, Luarca, Spain. Ochoa was educated at Malaga College from where he took his B.A. degree in 1921. His interest in biology was greatly stimulated by the publications of the great Spanish neurohistologist, Ramon Y. Cajal (Nobel Laureate). He obtained his M.D. in 1929 from the Medical School of the University of Madrid.

After graduating in 1929, Ochoa went with the aid of the Spanish Council of Scientific Research, to work under Otto Meyerhof (Nobel Laureate) at the *Kaiser Wilhelm Institute fuer Medizinische Forschung* at Heidelberg. During this period he worked on the biochemistry and physiology of muscle, and his outlook and training were decisively influenced by Meyerhof.

Returning to Madrid in 1934, he was appointed Lecturer in Physiology and Biochemistry there and later became Head of the Physiology Division of the Institute for Medical Research, Madrid. In 1936, he was appointed Guest Research Assistant in Meyerhof's Laboratory at Heidelberg, where he worked on some of the enzymatic steps of glycolysis and fermentation. In 1937, he held a Ray Lankester Investigatorship at the Plymouth Marine Biological Laboratory and from 1938 until 1941 he worked on the biological function of vitamin B, with Professor R.A. Peters at Oxford University, where he was appointed Demonstrator and Nuffield Research Assistant.

While he was at Oxford he became interested in the enzymatic mechanisms of oxidative metabolism and in 1941 he went to America and worked, until 1942 at the Washington University School of Medicine at St. Louis.

OCHOA, SEVERO
Spain/USA

Ochoa's research has dealt mainly with enzymatic processes in biological oxidation and synthesis and the transfer of energy. It has contributed much to the knowledge of the basic steps in the metabolisms of carbohydrates and fatty acids, the utilization of carbon dioxide, and the biosynthesis of nucleic acids.

Ochoa has contributed more than 3,000 research papers on biochemistry. Apart from being a member of the US Academy of Sciences and American Philosophical Society, he is also a foreign member of Indian National Science Academy, Soviet, Polish and West German Academy of Sciences.

Note: The 1959 prize was awarded jointly to Kornberg and Ochoa.

Literature

For his lyrical poetry, which with classical fire expresses the tragic experience of life in our own times.

Quasimodo, Salvatore, b.—August 20, 1901, Modica, Italy, d.—June 14, 1968, Naples. An Italian poet, critic and translator who was originally a leader of the introverted and symbolistic Hermetic poets. After World War II he became a powerful poet of modern social issues. He expressed the tragic experience of life in modern times through his poetry. He was a Sicilian like the other great Italian litterateurs Giovanni Verga, Luigi Pirandello and Elio Vittorini. Like Vittorini he was also the son of a railroad worker. He was first educated near Syracuse and Messina and studied engineering and mathematics at Palermo, then left for the north and graduated in engineering from Rome.

QUASIMODO, SALVATORE
Italy

He spent the next ten years as an engineer for the Italian Government but wrote poems in his spare time. His first poem appeared in the Florentine periodical *Solaria*. After the publication of his first collection of poetry *Acque a terre* (1930, Water and Land), he gradually became a promoter of Hermetic ideas. After 1955, he abandoned his engineering profession and took to teaching Italian literature in a Milanese conservatory. His later poetry collections *Oboe sommerse* (1932, Sunken Oboe), *Odore di Eucalyptus* (1933, Scent of Eucalyptus) and *Erato e Apolion* (1936) are written in a sophisticated style and symbolism of Hermeticism. With *Poesie* (1938) and *Ed e Subito Sera* (1942, And Suddenly it's Evening) his Hermetic period ended.

After World War II, he published *Giorno dopo giorno* (1947, Day After Day) which contains many striking poems including *Alle fronde dei salici* (On the Willow Branches) recalling the horrors of the Fascist regime and the guilt of Italy. Between 1930 and his demise he published a series of translations like *Litrici greci* (1940); containing plays of the Greek tragic playwrights. He edited two anthologies of Italian poetry and wrote many essays collected in *Il Poeta e il politico e altri saggi* (1960, The Poet and the Politician and other Essays, 1964).

Peace

Noel-Baker, Philip J., b.—November 1, 1889, London, d.—October 1982, London. A statesman and advocate of international disarmament. He was fluent in seven languages and campaigned widely for 40 years for peace through multilateral disarmament. He was born in a Canadian quaker family. He was a noted athlete; he ran in the 1912 and 1920 Olympic Games and was captain of the British Olympic team in 1924. He won a silver medal for 1500 meters race at the Antwerp Olympic games in 1920. During World War I he served with ambulance units in France, Belgium and Italy and was decorated for distinguished service.

NOEL-BAKER, PHILIP J.
Great Britain

He was elected a member of the British delegation of the Paris Peace Conference in 1919 and subsequently joined the League of Nations secretariat. He assisted Nansen, the Arctic explorer and humanitarian, for his work with war refugees. At the League of Nations assembly in 1923-24, he served as personal assistant to Lord Cecil of Chelwood, promoter of the League. He also aided

Arthur Henderson, president of the disarmament conference at Geneva in 1932-33. Noel-Baker sat in the House of Commons as a Labour member from 1929 to 1936. He held, among other offices, the secretaryship of state for Air and Commonweath Relations (1947-50) and the Ministry of Fuel and Power (1950-51). Although busy in government service from 1943, he helped to draft the United Nations charter. His survey of the disarmament problem was published as *The Arms Race: A Programme for World Disarmament* (1958).

1960

PHYSICS

Glaser, Donald A.

CHEMISTRY

Libby, Willard Frank

PHYSIOLOGY OR MEDICINE

Burnet, Sir Frank Macfarlane

Medawar, Sir Peter Brian

LITERATURE

Perse, Saint-John

PEACE

Lutuli, Albert John

1960

Physics

For the invention of the bubble chamber.

Glaser, Donald A., b.—September 21, 1926, Cleveland, Ohio. A winner of the prize for his invention and development of the bubble chamber, a research instrument used to observe the behaviour of subatomic particles. After graduating from Case Institute of Technology, Cleveland, in 1946, he attended California Institute of Technology, Pasadena, where he received Ph.D. in physics in 1949, then he began teaching at the University of Michigan, where he was professor of physics until 1959. There he conceived the idea for the bubble chamber, which has become a widely used instrument because it allows precise measurement of the paths of subatomic particles. In 1952 Glaser developed his first "bubble chamber" with ether as liquid. But later he used liquid hydrogen for greater efficiency. Bubble chambers are very useful for high energy particles which are more quickly slowed and form shorter and more curved paths that can be studied well.

GLASER, DONALD A.
USA

He was one of the youngest scientists to be awarded a Nobel prize at the age of only 34 years. In 1959, he joined the staff of the University of California at Berkeley, where he became professor of physics and molecular biology in 1964.

Chemistry

For his method to use carbon-14 for age determination in archaeology, geology, geophysics, and other branches of science.

Libby, Willard Frank, b.—December 17, 1908, Grand Valley, Colorado. A chemist whose technique of radioactive carbon dating has proved a valuable tool for archaeologists, anthropologists and geo-scientists. He obtained his Ph.D. from the California University at Berkeley and worked on its faculty from 1933 to 1945.

LIBBY, WILLARD FRANK
USA

While associated with the first atom bomb project he developed a method for separating uranium isotopes which was an essential step in the construction of the first bomb. He joined the Institute of Nuclear Studies of the Chicago University in 1949 and worked till 1959. In 1946, he showed that tritium, the heaviest isotope of hydrogen, could be produced by cosmic radiation. In the following years he and his students developed the Carbon 14 (C_{14}) dating technique and determined the age of many archaeological specimens. He also served on the US Atomic Energy Commission and was professor of chemistry at the University of California, Los Angeles. His most famous book is *Radiocarbon Dating* (1955).

Physiology or Medicine

For discovery of acquired immunological tolerance.

Burnet, Sir Frank Macfarlane, b.—September 3, 1899, Traralgon, Victoria, Australia. He was educated at the Victoria State School and at Geelong College, completing his medical course at the University of Melbourne, where he obtained MBBS in 1922 and MD in 1923.

In 1923, Burnet went to the Walter and Eliza Hall Institute of the University of Melbourne to do research work on the agglutinin reactions in typhoid fever.

BURNET, Sir FRANK MACFARLANE
Australia

In 1926, he was awarded a Beit Fellowship for Medical Research and worked for a year at the Lister Institute, London. His work on the agglutinins of typhoid fever mentioned above was followed by the work on viruses for which he became world famous.

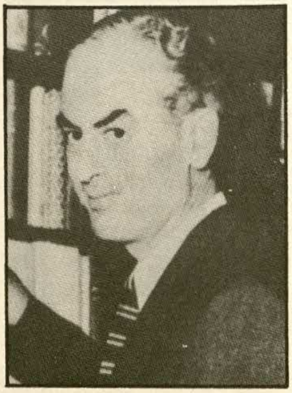
In 1935, he isolated a strain of "influenza A" virus in Australia, and subsequently did much work on serological variations of the influenza virus and on Australian strains of the swine influenza. He also published papers on variations in the virulence of influenza virus and on the mutation rates in it, which he calculated.

In 1946, in collaboration with W.I.B. Beveridge, Burnet devised a technique for cultivating viruses on the chorioallantoic membrane of chicken embryos and a method for determining the relative concentration of the materials inoculated into these membranes by counting and statistically analysing the number of lesions that appear on the membranes. In 1947, he discovered, in collaboration with Stone, the receptor-destroying enzyme present in *Vibrio cholerae*, a discovery which led to the isolation of neuraminic acid.

◆

For discovery of acquired immunological tolerance.

Medawar, Sir Peter Brian, b.—February 28, 1915, Rio de Janeiro, Brazil, d.—October 2, 1987. A British zoologist who received with Sir Macfarlane Burnet the prize for discovery of acquired immunological tolerance when he found (1935) that the adult animals injected with foreign cells early in life accept skin grafts from the original cell donor. In 1949, Burnet advanced the hypothesis that during embryonic life and immediately after birth, cells gradually acquire the ability to distinguish between their own tissue and unwanted cells and foreign material.



MEDAWAR, Sir PETER BRIAN
Great Britain

While working as a professor of zoology at the Universities of Birmingham (1947-51) and London (1951-62), he lent support to this theory when he found that fraternal cattle twins accept skin grafts from each other, indicating that certain substances known as antigens pass from the yolk sac of each embryo twin into the sac of the other. In a series of experiments on mice, he was able to produce evidence indicating that each animal cell contains certain genetically determined antigens important to the immunity process, since the recipient embryo injected with the donor's cells will accept tissue from all parts of the donor's body and from the donor's twin.

Medawar's work has resulted in a shift of emphasis in the science of immunology from one that attempts to deal with the fully developed immunity mechanism itself. The new concept of immunology has attracted the interest of scientists attempting to find ways to suppress the body's rejection of organ transplants. He was director of the National Institute for Medical Research, London. Medawar wrote *The Uniqueness of the Individual* (1957) and *The Future of Man* (1960).

Note: The 1960 prize was awarded jointly to Burnet and Medawar.

Literature

For the soaring flight and the evocative imagery of his poetry which in a visionary fashion reflects the conditions of our times.

Perse, Saint-John, b.—May 31, 1887, Saint-Leger-Les-Feuiles, Guadeloupe Island, d.—September 20, 1975, Presequile de Giens, France. A French poet and diplomat. He studied at the Universities of Bordeaux and Paris and in 1914 entered the French diplomatic service.

He was sent to China and was successively consul at Shanghai and secretary at Beijing. In 1921, he attended the disarmament conference at Washington as an expert on East Asian affairs. He was later secretary to the French pacifist statesman Aristide Briand (Nobel Laureate for Peace). In 1933, he was appointed secretary general to the Foreign Ministry with the rank of an Ambassador. He was dismissed from office in 1940 and deprived of the French citizenship by the Vichy Government.

He went of the USA and worked as a consultant on French literature in the Library of Congress. He came back to France in 1957. His early poetry was written before he started his career as a diplomat which includes *Eloges* (1911, Eloges and other Poems, 1944). His best known early work is the long poem *Anabase* (1924, Anabasis, translated by T.S. Eliot, 1930). During his exile, he wrote *Exil* (1942, Exile and other Poems, 1949) followed by *Poeme a l'Etrangere* (Poem to a Foreign Lady, 1943), *Quatre Poemes* (1944), *Vents* (1946, Winds, 1953), *Amers* (1957, Seamarks, 1958), *Chronique* (1960, English, 1961), *Oiseaux* (1962, Birds, 1966) and *Pour Dante* (1966).

PERSE, SAINT-JOHN
France

Peace

LUTULI, ALBERT JOHN
South Africa

Lutuli, Albert John, the last name also spelled as

Lurhuli, b.—1898, Rhodesia, d.—July 21, 1967, Stanger, South Africa. A teacher and religious leader in South Africa. He was the first African to be awarded a Nobel Prize for Peace. After graduating from the American Board of Missions teachers training college located at Adams College, he became one of its first three African instructors.

In 1936 he was elected chief of the Zulu community at Groutville, and in 1945 he joined the African National Congress. As he opposed the policies of South Africa's all white government, Lutuli was arrested in 1956. The government confined him to his rural neighbourhood (1959) for causing hostility between the whites and blacks. He was allowed to leave South Africa briefly to receive the prize, which was awarded to him in recognition of his nonviolent struggle against racial discrimination: He was inspired by the teachings of Mahatma Gandhi, who also started his movement against the white discrimination of the blacks in South Africa. His death came suddenly when he was accidentally struck by a train at a railway crossing.

1961

PHYSICS
Hofstadter, Robert
Mössbauer, Rudolf Ludwig
CHEMISTRY
Calvin, Melvin
PHYSIOLOGY OR MEDICINE
Von Békésy, Georg
LITERATURE
Andric, Ivo
PEACE
Hammarskjoeld, Dag Hjalmar Agne Carl

Physics

For his pioneering studies of electron scattering in atomic nuclei and for his thereby achieved discoveries concerning the structure of the nucleons.

Hofstadter, Robert, b.—February 5, 1915, New York City. A joint recipient with Rudolph Ludwig Mössbauer of the prize for his investigations of protons and neutrons, which revealed the hitherto unknown structure of these particles. This work was important for an understanding of nuclear forces and reactions. Hofstadter was educated at the City College of New York and graduated in 1935. He did his Ph.D. from Princeton University in 1938. During World War II, he worked on military equipment development at the National Bureau of Standards, Washington, D.C. He then joined the faculty of the Princeton University, where his principal scientific work dealt with the study of infrared rays, photoconductivity, crystal and scintillation counters. In 1950, he joined the Stanford University, where he used the high-voltage linear electron accelerator to measure and explore the structure of atomic nuclei. He found that both the proton and neutron have a central, positively charged core surrounded by a double cloud of "pi-mesons". Both clouds are positively charged in the proton, but in the neutron the inner cloud is negatively charged, thus giving a net zero charge for the entire particle. From his observations, he also deduced the existence of more massive mesons with very short life, which were shortly detected.

HOFSTADTER, ROBERT
USA

◆

For his researches concerning the resonance absorption of gamma radiation and his discovery in this connection of the effect which bears his name.

Mössbauer, Rudolf Ludwig, b.—January 31, 1929, Munich, Germany. A German physicist who with Robert Hofstadter shared the prize. He discovered the famous "Mössbauer effect", in 1957 before he got his doctorate from the Technische Hochschule of Munich. The effect is also called "recoil-free Gamma ray resonance absorption", a phenomenon resulting from the inter-action of atomic nuclei and gamma rays emanating the full

MÖSSBAUER, RUDOLF LUDWIG
Germany

energy of the ray without any recoil of the nucleus. This effect has been helpful in the verification of Albert Einstein's theory of relativity and the measurement of the magnetic field of atomic nuclei and to study other properties of solids. The experiments conducted in England and the United States in 1960 showed that the loss of absorption of rays was corresponding to a lengthening of wavelength with increase in gravitational field as predicted in the general theory of relativity. He became a professor of physics at the California Institute of Technology in Pasadena. He returned to Munich in 1964 to become professor of physics at the Technische Hochschule.

Note: The 1961 prize was awarded jointly to Hofstadter and Mössbauer.

Chemistry

For his research on the carbon dioxide assimilation in plants.

Calvin, Melvin, b.—April 8, 1911, St. Paul, Minnesota. He received the B.S. degree in chemistry in 1931 at the Michigan College of Mining and Technology, and the Ph.D. from the University of Minnesota in 1935. He spent two years (1935-37) as a Fellow of the Rockefeller Foundation at the University of Manchester, England. He joined the faculty of the University of California at Berkeley in 1937, and has been a professor there since 1947. In 1946, he was appointed Director of the Lawrence Radiation Laboratory.

Calvin is married and has two daughters and a son.

Calvin's discovery that phosphoglyceric acid is the primary assimilation product led to the important conclusion that there is an intimate connection between photosynthesis and carbohydrate metabolism as a whole.

He proceeded to map out the path between the primary product and the end-products of assimilation, the various carbohydrates. He showed that for reduction of phosphoglyceric acid to the carbohydrate level, the plant has to supply both a reducing agent and a so-called energy-rich phosphate. He also demonstrated that light energy is not directly involved in the reactions of assimilation, but used for regeneration of co-factors which are consumed in the assimilation reactions. Further work by him showed that, as the carbon dioxide acceptor is consumed during the fixation reaction, it is regenerated from the assimilation products. It was shown that between the primary product and the acceptor there are no less than ten intermediary products, and the reactions between these products are catalyzed by eleven different enzymes.

CALVIN, MELVIN
USA

He is the recipient of several scientific awards and medals. He is the member/fellow of many learned societies including the Royal Society of London. He holds honorary doctorates from several universities.

Calvin's books include *The Theory of Organic Chemistry* (1941), *Isotopic Carbon* (1949), *The Path of Carbon in Photosynthesis* (1957), *Chemical Evolution* (1961), *Photosynthesis of Carbon Compounds* (1962).

Physiology or Medicine

For his discoveries of the physical mechanism of stimulation within the cochlea.

Von Békésy, Georg, b.—June 3, 1899, Budapest, Hungary, d.—June 13, 1972, Honolulu. He received his early education in Munich, Constantinople, Budapest, and in a private school in Zuerich. Having passed the Swiss *Maturitaetspruefung* he studied chemistry at the University of Bern. After a short military service he received his Ph.D. in physics in 1923 from the University of Budapest.

His work in the research laboratory of the Hungarian Post Office was concerned mainly with problems of long-distance telephone transmission. There it was possible for him to spend considerable time in the study of the ear as a main component of the human transmission system. He used to visit the autopsy rooms of the hospitals and the mechanical workshops of the Post Office in pursuit of his quest for the knowledge of hearing mechanics.

VON BÉKÉSY, GEORG
Hungary/USA

He left Hungary in 1946 for Sweden, where he researched at the Karolinska Institute and at the Technical Institute in Stockholm. It was during this period that he developed a new type of audiometer which is operated by the patient and has applications outside the field of hearing. In 1947, he went to the United States and worked until his retirement at Harvard University in the Psycho-Acoustic Laboratory.

Literature

For the epic force with which he has traced themes and depicted human destinies drawn from the history of his country.

Andric, Ivo, b.—October 10, 1892, Travnik, Yugoslavia, d.—March 13, 1975, Belgrade. A writer of Serbo-Croatian novels and short stories. He studied at Zagreb, Cracow, Vienna and Graz and was Ambassador in Berlin during World War II.

His capabilities as a writer were recognized early. He became famous with *Ex Ponto* (1919), a lyrical prose written during his incarceration by the Austro-Hungarian authorities for Yugoslav nationalistic activities. This work was followed by *Nemiri* (Turbulences). In 1924, he published 3 volumes of short stories under the title *Pripovetke* (Stories) which was recognized in Yugoslav literary circles. *Travinicka hronika* (1945, Bosnian Story, 1959), *Na Drini cuprija* (1945, The Bridge on the Drina, 1959) and *Gospodjica* (The Woman from Sarajevo, 1945) are related to the history of Bosnia.

ANDRIC, IVO
Yugoslavia

As a Yugoslav diplomat he lived in many countries. His native province with its varied ethnic types, folklores and anecdotes provided him with the themes of his works.

Peace

Hammarskjoeld, Dag Hjalmar Agne Carl, b.—July 29, 1905, Jonkoping, Sweden, d.—September 18, 1961, near Ndola, Zambia. An economist and statesman and the second Secretary General of the United Nations (1953-61), whose leadership enhanced the prestige and effectiveness of the United Nations and who was posthumously awarded the Nobel Peace prize.

He was the son of Hjalmar Hammarskjoeld, prime minister of Sweden (1914-17) and Chair-

HAMMARSKJOELD, DAG HJALMAR AGNE CARL
Sweden

man of the Nobel Prize Foundation (1929-47). Dag studied law and economics at the universities of Uppsala and Stockholm and taught political economy at Stockholm (1933-36). He joined the Swedish Civil service as permanent undersecretary in the Ministry of Finance and subsequently became president of the board of the Bank of Sweden. From 1947 he served in the Ministry of Foreign Affairs, where he was responsible for problems of trade. In 1951, he was appointed minister of state with the functions of deputy foreign minister.

In the same year he was chosen vice-chairman of Sweden's delegation to the UN General Assembly, of which he became Chairman in 1952. On April 10, 1953, five months after the resignation of Trygve Lie of Norway as Secretary General, Hammarskjoeld was elected to the office for a term of five years. In September 1957 he was unanimously re-elected for another five years.

The Korean War, in which UN forces had intervened, ended early in Hammarskjoeld's first year as secretary general. For several years thereafter he was most concerned with fighting and threats of fighting in the Middle East between Israel and Arab states. He and the Canadian statesman Lester Pearson (Nobel Peace Prize Winner for 1957) participated in the resolution of the Suez Canal Crisis that arose in 1956. Hammarskjoeld also played a prominent role in the 1958 crisis in Lebanon and Jordan, which threatened to involve the Arab nations in war. Belgian Congo became the independent Republic of the Congo in 1960, and Hammarskjoeld sent a UN force to suppress the civil strife that began there soon afterwards.

In September 1960 his action was denounced by the Soviet Union, which demanded that he resign and the office of secretary general be replaced by a three-man board (*Troika*) comprising of representatives of the Western, Communist, and neutral nations. Soon after, while on a peace mission to president Moise Tshombe of the Congolese province of Katanga, Hammarskjoeld was killed in a plane crash. He was a quiet man, a lover of arts who revealed his emotions in *Markings* (published posthumously at his direction, 1964). The work is a spiritual diary that he described as "a sort of white book concerning my negotiations with myself and with God."

1962

PHYSICS

Landau, Lev Davidovic

CHEMISTRY

Kendrew, Sir John Cowdery
Perutz, Max Ferdinand

PHYSIOLOGY OR MEDICINE

Crick, Francis Harry Compton
Watson, James Dewey
Wilkins, Maurice Hugh Frederick

LITERATURE

Steinbeck, John

PEACE

Pauling, Linus Carl

1962

Physics

For his pioneering theories for condensed matter, especially liquid helium.

Landau, Lev Davidovic, b.—January 22, 1908, Baku, Azerbaijan, d.—April 1, 1968, Moscow. One of the greatest physicists of the 20th century who won international recognition for many contributions in low-temperature physics, atomic and nuclear physics, solid state physics, stellar energy, and plasma physics. Several glossaries in physics bear testimony to his name.

LANDAU, LEV DAVIDOVIC
USSR

Landau graduated from the Leningrad State University in 1927. He also studied at Bohr's Institute for Theoretical Physics at Copenhagen, and made brief visits at other major centres for physics. As head of the Department of General Physics at Kharkov University, he began a school that soon became the leading centre for the study of theoretical physics in Soviet Russia. He gave a mathematical treatment of magnetic domains in 1935 which were helpful in the understanding of ferromagnetic materials. In 1937 he joined the Institute of Physical Problems at Moscow and started work on low-temperature phenomena. He gave theoretical predictions on the properties of helium II and III on the basis of quantum mechanics. He was awarded the Lenin Prize and many other prizes. He is the co-author of a famous multi-volume book, *Theoretical Physics*. He died of head injury in 1968.

Chemistry

For their studies of the structure of globular proteins.

Kendrew, Sir John Cowdery, b.—March 24, 1917, Oxford. His father was Reader in Climatology in the University of Oxford and his mother was an art historian.

Kendrew was educated at the Dragon School, Oxford, and Cliton College, Bristol. In 1936 he went to Trinity College, Cambridge, and graduated in chemistry in 1939. He was doing research on reaction kinetics in the Department of Physical Chemistry at Cambridge during the first few months of the war. He then worked on radar as a member of the Air Ministry Research Establishment, which later came to be known as Telecommunication Research Establishment. He took his Ph.D. in 1949 and his D.Sc. in 1962 from Cambridge. He was Deputy Chairman of the Medical Research Council Laboratory for Molecular Biology at Cambridge and Chairman of the Defence Scientific Advisory Council.

He is unmarried.

Kendrew incorporated heavy atoms, generally mercury or gold, into the myoglobin molecule at difficult positions to determine its structure. The calculations would not have been practicable if he had not access to a very large electronic computer. His work produced a three dimensional model of myoglobin at 6 A resolution in 1957, and an almost complete structure in 1960.

KENDREW, Sir JOHN COWDERY
Great Britain

Kendrew was elected Fellow of Peterhouse College in 1947 and of the Royal Society in 1960. He became an honorary member of the American Society of Biological Chemists in 1962. He has been part-time Deputy to the Chief Scientific Advisor, Ministry of Defence, since 1960. He was made Companion of the British Empire in 1962. He is Founder and Editor-in-Chief of the *Journal of Molecular Biology*, and Honorary Secretary of the British Biophysical Society.

Kendrew is a lover of music, shows keen interest in the history of art and enjoys travelling. ◆

For their studies of the structure of globular proteins.

Perutz, Max Ferdinand, b.—May 19, 1914, Vienna.

Perutz joined the University of Vienna in 1932. He later joined Cambridge for his Ph.D. and became a research student at the Cavendish Laboratory under J.D. Bernal in 1936. He was appointed Assistant to Sir Lawrence Bragg, Nobel Laureate in Physics (1915), under a grant from the Rockefeller Foundation in 1939, which continued until 1945. He was appointed in 1964 head of the newly established Medical Research Council Unit for Molecular Biology.

He married in 1942 and has two children.

In 1937 Perutz tried to determine the structure of haemoglobin by X-ray diffraction, and was encouraged by Sir Lawrence Bragg. He incorporated mercury atoms, which are heavy, into definite positions in the haemoglobin molecule, altering the diffraction pattern to some extent and using the changes in a more direct structure determination. He carried out three-dimensional X-ray analysis of the oxyhaemoglobin of horse and of the reduced haemoglobin of man. The results showed that the reduced and the oxygenated forms differ markedly in structure, and that a molecular rearrangement accompanies the reaction of haemoglobin with oxygen.

PERUTZ, MAX FERDINAND
Austria/Great Britain

Perutz is a Fellow of the Royal Society and was made Companion of the British Empire in 1962. He is an honorary member of the American Academy of Arts and Sciences.

Perutz's recreations are walking, skiing and gardening.

Note: The 1962 prize was awarded jointly to Kendrew and Perutz.

Physiology or Medicine

For their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material.

Crick, Francis Harry Compton, b.—June 8, 1916, Northampton, England. Crick had his higher education at the University College, London and Cambridge University. He joined the Medical Research Council Unit at the Cavendish Laboratory, Cambridge, in 1949, and remained there until 1976. He is now a non-resident Fellow of the Salk Institute for Biological Studies at California.

CRICK, FRANCIS HARRY COMPTON
Great Britain

Watson convinced Crick that knowledge of DNA's three-dimensional structure would make its role in heredity apparent. In 1953 Watson and Crick were able to construct a molecular model consistent with the known physical and chemical properties of DNA. The model confirmed Watson's reasoning. It was obvious to them that if the strands were separated, each would serve as a pattern for the formation of a new strand identical to the former. This copying process explained replication of the gene and, eventually, of the chromosome known to occur in dividing cells. Their model proved that DNA played a central role in the hereditary determination of the structure and function of a cell.

Crick has published numerous scientific papers and two books, *Molecules and Men* (1967) and *Life Itself* (1981). ◆

For their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material.

Watson, James Dewey, b.—April 6, 1928, Chicago. A geneticist and biophysicist who played a crucial role in discovering the molecular structure of deoxyribonucleic acid (DNA), the socalled gene substance that is the basis of heredity.

His virus research at the University of Indiana in Bloomington, and the experimental (1944) work of the microbiologist Avery, proved that DNA affects hereditary traits which convinced him that the gene could be understood only after something was more known about nucleic acid molecules. While studying biochemistry in Copenhagen (1950), he learned that certain biophysicists were studying the structures of large biological molecules. Some of these scientists, working in the Cavendish Laboratory at Cambridge, hoped that photographic patterns made by X-rays that had been shot through protein crystals could provide clues about the structure of protein molecules.

WATSON, JAMES DEWEY
USA

After obtaining a research position at the Cavendish Laboratory (1951-53) he learned X-ray diffraction techniques and worked with the British biophysicist Francis Crick on the problem of DNA structure. In 1952, he solved the structure of the protein coat surrounding the tobacco mosaic virus (TMV) but made no progress with DNA. In the spring of 1953, he saw that the essential DNA components of four organic basis must be linked in definite pairs, adenine with thymine and guanine with cystosine. Watson's discovery was the key factor which enabled him and Crick to formulate a molecular model for DNA as a double helix, which looks like a spiral staircase, consisting of two intertwined sugar-phosphate chains and the flat base pairs forming the steps between them. Their model showed how the DNA molecule could duplicate itself. The two chains were complementary, if separated, each would serve as the basis for the formation of the other. Thus it became known how genes, and eventually chromosomes, duplicate themselves. The Watson-Crick DNA model was made public in 1953 in an article in *Nature*. The profound biological implications of the model, mentioned in the article, were elaborated soon after in another paper, published by them.

At the California Institute of Technology and Harvard University where he became professor of biochemistry and molecular biology, Watson helped to break the "genetic code" given out by the DNA base sequences and found the RNA (ribonucleic acid) messenger which transfers the DNA code to the protein-forming structures of the cell.

In 1965, Watson published *Molecular Biology of the Gene*, which became one of the most modern texts on biology. He later wrote *The Double Helix* (1968), a personal account of his recollections about the discovery of DNA and the people associated with it. In 1968, he was made the head of the Laboratory of Quantitative Biology of Cold Spring Harbour, Long Island, New York, an international centre for research in molecular biology. His current research interest includes cancer research.

◆

For their discoveries concerning the molecular structure of nucleic acids and its significance for information transfer in living material.

Wilkins, Maurice Hugh Frederick, b.—December 15, 1916, Pongaroa, New Zealand. He studied physics at St. John's College, Cambridge, taking his degree in 1939. He then went to Birmingham University, where he became research assistant to Randall in the Physics Department. He obtained his Ph.D. in 1940.

WILKINS, MAURICE HUGH FREDERICK
New Zealand and Great Britain

In 1945, he became a lecturer in physics at St. Andrews' University, Scotland. He had spent seven years in physical research and then diverted his attention to biophysics. He was greatly influenced by Schroedinger's book *What is Life* and was struck by the concept of a highly molecular structure which controlled the living process. The biophysics project moved in 1946 to King's College, London, where he was a member of the staff of the newly formed Medical Research Council Biophysics Research Unit. He was first concerned with genetic effects of ultrasonics, then he changed his research to development of reflecting microscopes for ultraviolet microspectrophotometric study of nucleic acids in cells. He also studied the tobacco mosaic virus (TMV).

An ardent collector of sculptures and a good gardener, Wilkins married in 1959 and has a daughter and a son.

Note: The 1962 prize was awarded jointly to Crick, Watson and Wilkins.

Literature

For his realistic and imaginative writings, combining as they do sympathetic humour and keen social perception.

STEINBECK, JOHN
USA

Steinbeck, John, b.—February 27, 1902, Salinas, California, d.—December 20, 1968, New York City. An author who gained fame during the thirties for his powerful novels about the poor agricultural community of America. The greatest of those, *The Grapes of Wrath* (1939), summed up the miseries of decades of depression, and aroused widespread sympathy for the plight of the poor landless migratory farmers.

He attended the Stanford University, California, irregularly between 1920 and 1926, but did not take a degree. Before his books attained success, he supported himself as a manual labourer. *Cup of Gold* (1929), his first novel, was followed by *The Pastures of Heaven* (1932), *To a God Unknown* (1933), *Tortilla Flat* (1935), and *Of Mice and Men* (1937).

During World War II he wrote effective pieces of propaganda literature. He also served as a war correspondent and explored the relationship between man and society in *Sea of Cortez* (1941).

His immediate post-war works are *Cannery Row* (1945), *The Pearl* (1947) and *The Wayward Bus* (1947). He also wrote scripts for films. He won the Pulitzer Prize in 1940.

Peace

PAULING, LINUS CARL
USA

Pauling, Linus Carl, b.—February 28, 1901, Portland, Oregon. He received the Nobel Prize for Chemistry in 1954. He received it for the second time for Peace for his ardent pacificist activities and campaign for the control and stockpiling of atomic weapons.

1963

PHYSICS

Wigner, Eugene P. / Goeppert-Mayer, Maria
Jensen, J. Hans D.

CHEMISTRY

Ziegler, Karl / Natta, Giulio

PHYSIOLOGY OR MEDICINE

Eccles, Sir John Carew / Hodgkin, Sir Alan Lloyd
Huxley, Sir Andrew Fielding

LITERATURE

Giorgos, Seferis

PEACE

Comité International de la Croix-Rouge
Ligué des Sociétés de la Croix-Rouge

PHYSICS
Wigner, Eugene P./Goeppert-Mayer, Maria
Jensen, J. Hans D.

CHEMISTRY
Ziegler, Karl/Natta, Giulio

PHYSIOLOGY OR MEDICINE
Eccles, Sir John Carew/Hodgkin, Sir Alan Lloyd
Huxley, Sir Andrew Fielding

LITERATURE
Seferis, Giorgos

PEACE
Comité international de la Croix-Rouge
Ligue des Sociétés de la Croix-Rouge

1963

Physics

For his contributions to the theory of the atomic nucleus and the elementary particles, particularly through the discovery and application of fundamental symmetry principles.

Wigner, Eugene P., b.—November 17, 1902, Budapest. A joint winner with Johannes H.D. Jensen and Maria Goeppert-Mayer of the prize for his many contributions to nuclear physics, which include his formulation of the law of conservation of parity. Wigner was educated as a chemical engineer and obtained his Ph.D. from the University of Berlin in 1925. After lecturing at the Technische Hochschule in Berlin, he went to the USA where he spent his academic life at the Princeton University as Professor of Mathematical Physics. He became a US citizen in 1937.

WIGNER, EUGENE P.
Hungary/USA

While he was in Europe he had developed the principles involved in applying group theory to quantum mechanics and evolved the concept of the symmetry in space and time that marks the behaviours of subatomic particles. In 1936, he worked out the theory of neutron absorption, which later proved useful in building nuclear reactors. With Leo Szilard and Edward Teller, both from Hungary, Wigner helped to persuade Albert Einstein in 1939 to write the historic letter to President F.D. Roosevelt that set in motion the US atomic bomb project. During World War II he worked at the Metallurgical Laboratory at the University of Chicago, where he helped Enrico Fermi to construct the first atomic pile.

Wigner also conducted research on quantum mechanics, the theory of the rates of chemical reactions, and nuclear structure. In 1960, he was presented with the Atoms for Peace Award. His publications include *Dispersion Relations and their Connection with Casualty* (1964) and *Symmetries and Reflections* (1967).

◆

For their discoveries concerning nuclear shell structure.

Goeppert-Mayer, Maria, b.—June 28, 1906, Kattowitz, Poland, d.—February 20, 1972, San Diego, California. A physicist and joint winner, with Jensen and Wigner, of the prize for their

GOEPPERT-MAYER, MARIA
Germany/USA

revealing explanation of the detailed properties of atomic nuclei in terms of a structure of shells or orbits in which the protons and neutrons are allowed to move. In 1930, the year she received her Ph.D. from the University of Göttingen, she married an American chemical physicist named Mayer and joined the Johns Hopkins University. In 1939, she went to Columbia University, where she worked on the separation of uranium isotopes for the atom-bomb project. In 1945, she joined the Institute for Nuclear Studies at the University of Chicago. In 1947, she observed that some nuclei have anomalous properties, being more stable and more abundant in nature than most. All those nuclei have a particular number of neutrons and the same number of protons. In 1949, she explained these numbers of her own, which are now called "magic numbers" in terms of the nuclear shell theory. She and Jensen jointly wrote *Elementary Theory of Nuclear Shell Structure* (1955). In 1960 she became professor of physics at the University of California at La Jolla.

◆

For their discoveries concerning nuclear shell structure.

Jensen, J. Hans D., b.—June 25, 1907, Hamburg, d.—February 11, 1973, Heidelberg. A joint recipient with Maria Goeppert-Mayer and Eugene P. Wigner of the prize for explaining the detailed characteristics of atomic nuclei. According to their explanation, known as the "shell theory", a nucleus should be thought of not as a random motion of neutrons and protons around a point but rather as a structure of shells, or spherical layers, of differing radii, each of which is filled with neutrons and protons.

JENSEN, J. HANS D.
Germany

Jensen served on the faculty of the University of Hamburg from 1936 to 1941. He then joined the Institute of Technology in Hanover, leaving in 1949 to become professor at the University of Heidelberg. Mayer, Wigner, and Jensen proposed their nuclear shell model in 1949. He collaborated with Mayer in writing *Elementary Theory of Nuclear Shell Structure* (1955).

Note: The 1963 prize was divided, one-half being awarded to Wigner and the other half jointly to Goeppert-Mayer and Jensen.

Chemistry

For their discoveries in the field of the chemistry and technology of high polymers.

Ziegler, Karl, b.—November 26, 1898, Helsa, West Germany, d.—August 12, 1973, Mülheim. His father was a Lutheran minister. Ziegler studied chemistry at the University of Marburg, where he obtained his Ph.D. in 1920, and his 'Habilitation' in 1923. For a short period he was lecturer at Frankfurt, and in 1927 he took up the post of Professor of Chemistry at the University of Heidelberg. In 1936 he was appointed Professor and Director of the Chemical Institute Halle-Saale, and in 1943 he became Director of Kaiser Wilhelm Institute for Coal Research at Mülheim-in-Ruhr, which he held until his retirement in 1969.

Ziegler carried out a systematic study of the effects of substitution in hexaphenyl ethane on the dissociation equilibrium and reaction of the free radicals produced. New radicals were prepared by reactions of alkali metals and organometallic compounds with ethers and organic halides. By a series of events he showed that metal alkyls polymerised isoprene and butadiene.

Ziegler was the first to explain the reactions involved in the syntheses of rubber. His researches with lithium in organometallic chemistry produced compounds more reactive than the Grignard reagents on which they are based. His work on complex ring structure found use in synthesising the aroma of musk used in perfumes.

After World War II Ziegler concentrated on research into organoaluminium compounds. Nickel was accidently found to catalyse the displacement of one olefin from trialkyl aluminium by another. This led to a systematic scrutiny of other metals, which resulted in finding that zirconium acetylacetonate added to triethyl aluminium gave a polyethylene of very high molecular weight.

ZIEGLER, KARL
Germany

The combination of trialkyl aluminium and titanium chloride was so active that it polymerised ethylene at ambient pressure and temperature in the presence of a solvent. This was the beginning of research that led to the use of new catalysts to produce long chain polymers of ethylene and butadiene. Ziegler's research gave birth to a new era in the plastics industry.

Ziegler was a great experimental chemist and teacher. The creation of synthetic plastics, fibres, rubbers, and film bear testimony to his research achievement. The industrial application of his work was his brains child, and he was successful in promoting the economic evaluation of his discoveries. He endowed the Kaiser Wilhelm Institute at Mülheim with a capital of 40 million marks to create a Ziegler Fund, which was regularly being funded by part of the royalties from the Ziegler Polyethylene process.

Ziegler was well known for his modesty, kindness, and friendliness, and he was closely attached to his family. He always kept away from politics. ◆

For their discoveries in the field of the chemistry and technology of high polymers.

Natta, Giulio, b.—February 26, 1903, Imperia near Genoa, d.—May 1, 1979, Milan. Natta was the son of a well-known judge, and studied Mathematics at the University of Genoa. But he changed to Chemical Engineering when he went to the Milan Polytechnic Institute, where he obtained his 'Doctore' at the early age of 21, and his "Libero Docente", three years later. He was Assistant Lecturer in Chemistry at Milan. In 1933 he was appointed Professor of General Chemistry at the University of Pavia, and two years later became Director of the Institute of Physical Chemistry in Rome. He was appointed Professor of Chemistry in Turin in 1937, and from 1938 he held the post of Professor and Director of the Milan Institute of Industrial Chemistry till his retirement in 1973.

Natta in the earlier days worked on the structural chemistry of minerals and inorganic materials used as heterogenous catalysts for certain important industrial processes. This work formed the basis of modern industrial synthesis of methanol, formaldehyde, butyraldehyde and succinic acid. In 1938 he initiated a programme for the production of synthetic rubber, and also investigated the use of petroleum derivatives, particularly olefins and diolefins as raw materials for chemical synthesis.

NATTA, GIULIO
Italy

In 1953 Natta began intensive study of macromolecules. He was a consultant to Italy's largest chemical company Montecatini, which on his suggestion purchased the rights for Ziegler's (Nobel Laureate) work, the commercial development of the products on the organo-metallic syntheses of aliphatic compounds. Using the catalysts evolved by Ziegler, he experimented with the polymerisation of propylene and succeeded in obtaining isolactic polypropylenes containing uniformly oriented methyl groups. Properties like high strength and high melting points of these polymers soon proved their considerable commercial importance. A number of companies around the world took up propylene polymerisation, and poly-propylene soon became a major new plastic.

Natta was a very unassuming, soft spoken man of slight stature, courteous and considerate to visitors from all over the world who came to him out of scientific interest or to pursue the industrial development of his discoveries. He was a lover of nature and an active mountaineer. He was interested in collecting fossils, which were displayed in his home in Milan and also edible fungi about which he was well informed.

Note: The 1963 prize was awarded jointly to Ziegler and Natta.

Physiology or Medicine

For their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane.

Eccles, Sir John Carew, b.—January 27, 1903, Melbourne, Australia. A physiologist, who received with Alan Hodgkin and Andrew Huxley the prize for his discovery of the chemical means by which impulses are communicated or suppressed by nerve cells. When he began his investigations at Oxford University (1925-37), it was known only that the maintenance of polarity of resting nerve-cell membranes depends upon the exclusion of positively charged sodium ions (Na+) from the interior of the cell. In 1952, when he was the professor of physiology at the Australian National University at Canberra (1951-66), he showed that the excitement of a nerve cell by an impulse causes a kind of synapse to release a substance (probably acetylcholine) into the neighbouring cell that expands the pores in nerve cell membranes. The expanded pores then allow free passage of sodium ions into the neighbouring nerve cell and reverse the polarity of electrical charge. This sequence of electrical changes, which constitute the nerve impulse, is conducted from one cell to the other. In the same way he found that an excited nerve cell induces another type of synapse to release a substance into the neighbouring cell which promotes outward passage of positively charged potassium (K−) ions across the membrane, reinforcing the existing polarity and inhibiting the transmission of an impulse.

ECCLES, Sir JOHN CAREW
Australia

His work was based largely on the findings of Hodgkin and Huxley, and had a profound influence on the medical treatment of nervous diseases and researches on kidney, heart, and the brain. Among his books are *Reflex Acivity of the Spinal Cord* (1932) and *The Physiology of Nerve Cells* (1957).

◆

For their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane.

Hodgkin, Sir Alan Lloyd, b.—February 5, 1914, Banbury, Oxfordshire. A physiologist and biophysicist who received with Andrew Huxley and Sir John Eccles the prize for his discovery of the chemical processes responsible for the propagation of impulses along individual nerve fibres. After conducting radar research for the British Air Ministry, he joined the Cambridge University, where he worked with his student Andrew Huxley on measuring the electrical and chemical behaviour of individual nerve fibres. By inserting microelectrodes into the giant nerve fibres of the squid *Loligo forbesi*, they were able to show that the electrical potential of a fibre during conduction of an impulse exceeds the potential of the fibre at rest, contrary to the behaviour predicted by the current theory, which postulated a breakdown of the nerve membrane during impulse conduction.

HODGKIN, Sir ALAN LLOYD
Great Britain

They knew that the activity of a nerve fibre depends on the fact that a large concentration of potassium ions is maintained inside the fibre, while a large concentration of sodium ions is found in the surrounding tissue fluid. Their experimental results indicated that the nerve membrane allows only potassium to enter into the fibre during the resting phase but allows sodium to penetrate when the fibre is excited. Hodgkin has served as research professor for the Royal Society since 1952 and wrote *Conduction of the Nervous Impulse* (1964).

◆

For their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane.

Huxley, Sir Andrew Fielding, b.—November 22, 1917, Hamstead, London. A British physiologist, who shared the prize with Alan Lloyd Hodgkin and Sir John Carew Eccles for researches in nerve conduction.

He is the step brother of the noted biologist Sir Julian and of the famous novelist Aldous Huxley. He was educated at University College School, Westminster School and Trinity College, Cambridge, of which he was fellow (1941) and a director of studies in 1952-60. During World War II he did research for the anti-aircraft command (1940-42) and for the admiralty (1942-45). He was demonstrator (1946-50), assistant director of research (1951-59) and reader in experimental biophysics (1959-60) in the department of physiology at Cambridge University. He became Jodrell professor of physiology, University College, London, in 1960 and Royal Society research professor there in 1969.

HUXLEY, Sir ANDREW FIELDING
Great Britain

Like those of his intimate collaborator, Hodgkin, Huxley's researches were concerned largely with the physicochemical analysis of the fundamental phenomena involved in the excitation in a peripheral nerve fibre and during conduction of excitation along it. Huxley has made contributions of fundamental importance to the knowledge of the intricacies in the contraction of a muscle fibre.

Note: The 1963 prize was awarded jointly to Eccles, Hodgkin and Huxley.

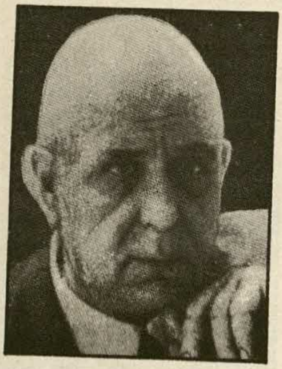
Literature

For his eminent lyrical writing, inspired by a deep feeling for the Hellenic world of culture.

Giorgos, Seferis, b.—March 13, 1900, Smyrna, Turkey, d.—September 20, 1971, Athens. Seferis had his primary education in Athens and later in Paris where his father was in law practice. He studied literature and took a degree in law from the University of Paris.

He spent the summers of 1924 and 1925 in London and after his return to Athens was appointed to the Greek Foreign Ministry. He retired from the diplomatic service in 1962 and settled in Athens.

He was a prolific poet. He was a great translator of good literature.



GIORGOS, SEFERIS (pen-name of SEFERIADIS, GIORGOS
Greece

His works include *Strophe* (1931, Turning Point), *Sterna* (1931, The Cistern), *Mythistorema* (1935, Mythical Story), *Emerologio Katastromatos* (1940, Log Book 1), *Tertradio gymnasmaton* (1940, Exercise Book), *Poiimata* (1940, Poems), *Emerologio Katastromatos 2* (1944, Log Book 2), *Kichele* (1942, Thrush), *Poiimata 1924-46* (1950, Poems) and *Emerologio Katastromatos 3* (1945, Log Book 3). His poems have been translated into English, French, German, Italian, Spanish and Swedish. He wrote some good essays of which *Dokimos* (1944, Essays) and *Erotokritos* (1946) are notable. He is considered to be one of the greatest of Greek poets of this century.

Peace

COMITÉ INTERNATIONAL DE LA CROIX-ROUGE
Geneva

and

LIGUÉ DES SOCIÉTÉS DE LA CROIX-ROUGE
Geneva

The *Comité International de la Croix-Rouge* (International Committee of the Red Cross) and *Ligué de Societies de la Croix-Rouge* (League of the Red Cross Societies, Geneva) jointly received the prize.

Note: The prize for 1963 was divided equally between the above two.

1964

PHYSICS

Townes, Charles Hard

Basov, Nikolai Gennadievic

Prochorov, Aleksandre Mikhailovic

CHEMISTRY

Hodgkin, Dorothy Crowfoot

PHYSIOLOGY OR MEDICINE

Bloch, Konrad / Lynen, Feodor

LITERATURE

Sartre, Jean-Paul

PEACE

King, Jr., Martin Luther

1964

Physics

For fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser-principle.

Townes, Charles Hard, b.—July 28, 1915, Greenville, South Carolina. Townes graduated in 1935 from Furman University. He took his M.Sc. from Duke University and doctorate from California Institute of Technology in 1939. In 1939, Townes joined the technical staff of Bell Telephone Laboratories, where he worked on radar controlled bomb targetting systems used in World War II. In 1948, he joined the faculty of Columbia University. Three years later he had an idea that culminated in the construction of the "maser" which was soon followed by the "laser", a device utilizing visible light. By pumping energy into molecules and then stimulating them with a weak beam of light, the devices release energy as a strong, coherent beam of similar light. Apart from being useful tools in the laboratory, both 'masers' and 'lasers' have found many applications in radar, communications, astronomy, navigation, atomic clocks, surgery and industry. In 1960, Townes and Maiman succeeded in developing a Ruby Laser, the red light that came out of it was found to be highly monochromatic, coherent and intense.

TOWNES, CHARLES HARD
USA

From 1959 to 1961, Townes served as vice-president and director of research of the Institute for Defense Analyses, Washington, D.C. He was then appointed provost and professor of physics at Massachusetts Institute of Technology.

◆

For fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser-principle.

Basov, Nikolai Gennadievic, b.—December 14, 1922, Leningrad. A Russian physicist and winner of the prize along with Aleksandre Mikhailovic Prochorov of the Soviet Union and Charles H. Townes of the USA for fundamental research in

BASOV, NIKOLAI GENNADIEVIC
USSR

quantum electronics which led to the development of "maser" and "laser". Those devices produce parallel beams and microwaves and light. Basov graduated from the Moscow Engineering and Physics Institute in 1950 and obtained his Ph.D. in 1956. He was a deputy director of the Lebedev Institute in the 1960s. In 1959, he received the Lenin Prize for the suggestion of "maser" principle. The "laser" and "maser" have extensive uses in modern medicine and tele-communications.

◆

For fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser-principle.

Prochorov, Aleksandre Mikhailovic, b.—July 11, 1916, Atherton, Queensland, Australia. A physicist and recipient, jointly with Nikolai Gennadievic Basov of the USSR and Charles H. Townes of the USA of the prize for fundamental research in quantum electronics which led to the development of the "maser" and "laser" devices that have wide applications in astronomy, astronautics, medicine, industry, communications, and other fields. He graduated from Leningrad University in 1939 and took his doctorate in 1946. Prochorov joined the Lebedev Physical Institute, Moscow, as a senior associate in 1946. In 1955, he and Basov jointly suggested the "maser" principle of amplifying and emitting parallel electromagnetic waves that are all of the same wavelength. In 1954, Prochorov became head of the institute's Oscillation Laboratory and later professor at Lomonosov State University of Moscow. Prochorov was awarded the Lenin Prize in 1959.

PROCHOROV, ALEKSANDRE MIKHAILOVIC
USSR

Note: The 1964 prize was divided, one half being awarded to Townes and the other half jointly to Basov and Prochorov.

Chemistry

For her determinations by X-ray techniques of the structures of important biochemical substances.

Hodgkin, Dorothy Crowfoot, b.—May 12, 1910, Cairo, Egypt. A chemist whose determination of the structure of vitamin B_{12} brought her the prize. She studied X-rays of complicated macromolecules at Oxford. She and a co-worker took the first X-ray diffraction photograph of the protein pepsin at Cambridge in 1934. Later she made a survey of the sterols. She returned to Oxford as a tutor in chemistry in 1934.

From 1942 to 1949 she worked on a structural analysis of the antibiotic penicillin. She and her colleagues made their first X-ray photograph of vitamin B_{12}, one of the most complex non-protein compounds. They completely determined the atomic arrangement of vitamin B_{12}. Hodgkin spent much time in the 60s at the University of Ghana in West Africa.

HODGKIN, DOROTHY CROWFOOT
Great Britain

Physiology or Medicine

For their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism.

Bloch, Konrad, b.—January 21, 1912, Neisse, Germany, now in Poland. A biochemist who shared the prize with Feodor Lynen for their discoveries concerning the natural synthesis of cholesterol and fatty acids.

After receiving a chemical engineering degree at the Technische Hochschule, Munich, in 1934, Bloch went to Switzerland and then to the USA. He earned his doctorate in 1938 at Columbia University, where he became a research associate of Rudolf Schoenheimer in the isotopic analysis of cell metabolism. After teaching at the University of Chicago, he became professor of biochemistry at Harvard, continuing his research on lipids, especially the unsaturated fatty acids.

BLOCH, KONRAD
Germany/USA

In 1942 Bloch and David Rittenberg discovered that the two-carbon compound, acetic acid, was the major building block in the steps for biosynthesis of cholesterol. In his search to determine how acetic acid molecules combine to form first medium-sized, then larger units on the way to the formation of cholesterol, he was also joined by Feodor Lynen and his collaborators in Munich and J.W. Cornforth and G. Pepjak in England. Their discovery facilitated medical research on the relation of blood cholesterol levels in relation to atherosclerosis research in physiology; and research on the chemistry of terpenes, rubber and other isoprene derivatives.

◆

For their discoveries concerning the mechanism and regulation of the cholesterol and fatty acid metabolism.

Lynen, Feodor, b.—April 6, 1911, Munich. A German biochemist who was awarded the prize jointly with Konrad Bloch for work on the metabolism of cholesterol and other fatty acids. His father was Professor at Technical University. From 1930 he studied chemistry at the Munich University, and graduated with a thesis on the poison of the death cup. His Professor was the Nobel laureate Heinrich Wieland, who became his father-in-law in 1937. He obtained his doctorate from the University of Munich (1937) and was posted as a University lecturer in 1941. He became professor of biochemistry at Munich (1947) and was named the director of the Max Planck Institute for Cellular Chemistry (1954).

Lynen was the first to isolate "acetyl coenzyme A", the compound from which both cholesterol and fatty acids are formed. With his collaborators he determined the mechanism of fatty acid degradation and elucidated the pathway of biosynthesis of compounds including cholesterol, squalene, terpenes, and natural rubber. While working on the mechanism of fatty acid synthesis, he isolated a multi-enzyme complex *fattyacid synthetase*

LYNEN, FEODOR
Germany

which catalyzes principal reactions of this process. He further found that biotin, an essential cofactor of the enzyme complex, binds carbon dioxide to form *1-N-carboxybiotin*. Lynen's team worked also on the biosynthesis of the amino acid cystine, and the formation of acetoacetic acid in the liver.

Note: The 1964 prize was awarded jointly to Lynen and Bloch.

Literature

For his work which, rich in ideas and filled with the spirit of freedom and the quest for truth, has exerted a far-reaching influence on our age.

Sartre, Jean-Paul, b.—June 21, 1905, Paris, d.—1980, Paris. A philosopher, novelist, playwright and an exponent of existentialism which denotes a philosophy acclaiming the freedom of the individual human being with the fullest benefits of his rights of living. He graduated from the Ecole Normale Superieure in Paris in 1929 and taught at Le Havre, Lyon and Paris *lycees* between 1931 and 1945.

SARTRE, JEAN-PAUL
France

His major philosophical writing was *L'Etre el le Neant* (1943, Being and Nothingness, 1956) which he wrote in defense of human dignity. His ethical message was proclaimed through *Les Chemins de la liberte* (in 3 volumes, 1945-49). He and his long-time girl friend novelist Simone de Beauvoir founded a monthly review *Les Temps Modernes* through which he publicised his ideas on socialism. His biographic writing *Flaubert* (1971) is a masterpiece.

He declined the prize giving personal and objective reasons including the belief that a writer should not allow himself to be turned into an institution.

Peace

King, Jr., Martin Luther, b.—January 15, 1929 Atlanta, Georgia, d.—April 4, 1968, Memphis, Tennesse. An eloquent black Baptist missionary who led the mass civil rights movement in the United States from the middle of 1950s. He won the prize for his leadership in applying principles of nonviolent resistance to the struggle for racial equality. He was a close follower of the non-violent principles of Mahatma Gandhi.

KING, Jr., MARTIN LUTHER
USA

King received a B.A. from Morehouse College, Atlanta, in 1948, a bachelor of divinity degree from Crozer Theological Seminary, Chester, Pennsylvania in 1951, and a Ph.D. from Boston University in 1955. He became a minister (1954) in Montgomery, Alabama, where he led a boycott of the transit system to force desegregation of the city's blacks and whites on public transports. He rose to national prominence through the organization of the Southern Christian leadership Conference, promoting non-violent tactics such as the massive March to Washington in 1963 to achieve civil rights. After 1965, King's leadership was challenged by the more militant blacks. His efforts to broaden his base of support to include poor people of all races ended with his assassination by one seasoned white-criminal, James E. Ray in 1968 at Memphis, Tennessee.

1965

PHYSICS

Feynman, Richard Pillips / Schwinger, Julian
Tomonaga, Sin-Itiro

CHEMISTRY

Woodward, Robert Burns

PHYSIOLOGY OR MEDICINE

Jacob, Francois / Lwoff, Andre
Monod, Jacques

LITERATURE

Solochov, Michail Aleksandrovic

PEACE

United Nations Children's Fund

1965

Physics

For their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles.

Feynman, Richard Pillips, b.—May 11, 1918, New York City. A recipient, with Julian S. Schwinger of the USA and Sin-Itiro Tomonaga of Japan, of the prize for work in correcting earlier inaccuracies of quantum electrodynamics, the theory that explains the interactions between radiation, electrons, and positrons.

FEYNMAN, RICHARD P
USA

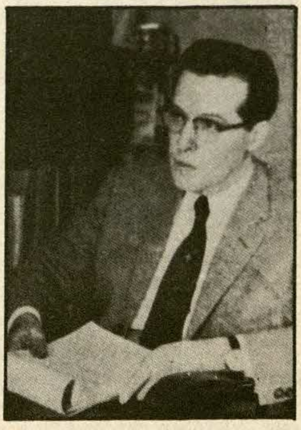
Feynman graduated from Massachusetts Institute of Technology in 1939 and obtained his doctorate from Princeton University in 1942.

Feynman served as a staff member of the US atom bomb project during World War II and became associate professor of theoretical physics at the Cornell University in 1945. He completed his reconstruction of a large part of quantum mechanics and electrodynamics—"quantum electrodynamics"—and resolved the meaningless results that the old quantum electrodynamic theory sometimes produced. He became a professor of theoretical physics at the California Institute of Technology in 1950. His publications include *Lectures in Physics* (in 3 volumes, 1963-65).

◆

For their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles.

Schwinger, Julian, b.—February 12, 1918, New York City. A physicist and joint winner with Feynman of USA and Sin-Itiro Tomonaga of Japan of the prize for his work in formulating quantum electrodynamics and thus reconciling quantum mechanics with Einstein's special theory of relativity. He was a child prodigy and entered the City College of New York at the age of only 14 and received his Ph.D. from Columbia University at the age of 21. From 1939 to 1941 he worked under the American nuclear physicist Robert Oppenheimer at the University of California, Berkeley.



SCHWINGER, JULIAN
USA

In 1945, he joined the faculty of Harvard University where he formulated his theory of quantum electrodynamics. He was unaware of the fact that Feynman and Tomonaga were also independently working on the same problem from different angles. The relativistic wave equation of the British physicist Dirac (Nobel Laureate) which had not been able to meet new experimental findings, served as the basis for Schwinger's work. His students at Cornell, Glasgow and Weinberg, also received Nobel Prizes for physics in 1979. ◇

For their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles.

Tomonaga, Sin-Itiro, b.—March 31, 1906, Kyoto, Japan, d.—July 8, 1979, Tokyo. A joint winner with Feynman and Schwinger of the prize for changes that made the theory of quantum electrodynamics fully consistent with the special theory of relativity. Tomonaga graduated from Kyoto University in 1929 and took his doctorate in 1939. He became professor of physics at Bunrika University (later the Tokyo University of Education) in 1941, the year he began his investigations on the problems of quantum electrodynamics.

TOMONAGA, SIN-ITIRO
Japan

During World War II he lost contacts with Western scientists, but in 1943 he completed and published his research. It was only after the war, that his work came to the notice of the West; at about the same time Feynman and Schwinger individually published the results of their research. It was found that each had achieved essentially the same goal from three different angles and had resolved the inconsistencies of the old theory without making any drastic changes.

Tomonaga was president of the Tokyo University of Education from 1956 to 1962, and the following year he was elected Chairman of the Japan Science Council. His most important work available in English translation is *Quantum Mechanics* (1962).

Note: The 1965 prize was awarded jointly to Feynman, Schwinger and Tomonaga.

Chemistry

For his outstanding achievements in the art of organic synthesis.

Woodward, Robert Burns, b.—April 10, 1917, Boston, Massachusetts; d.—July 8, 1979, Cambridge, Massachusetts.

He synthesized sterols, chlorophyll and other substances which were thought to be produced by only living beings. He was one of the most noted figures in the field of synthetic organic chemistry. He also synthesized strychnine, lysergic acid, reserpine and vitamin B_{12}. He determined the structure of penicillin and terramycin. As a child he had a liking for chemistry and he constructed a laboratory in the basement of his house. He was a genius and obtained a Ph.D.

WOODWARD, ROBERT BURNS
USA

from the Massachusetts Institute of Technology at the young age of only 20 years!

In 1941, he joined the faculty of chemistry of the Harvard University. Together with his colleague William E. Doering he synthesized quinine in 1944 and protein analoges in 1947. He was professor of chemistry at Harvard in 1950, Morris Loeb Professor in 1953 and Donner Professor of Science in 1960. At the time of his death he was working on the synthesis of the important antibiotic erythromycin.

Physiology or Medicine

For their discoveries concerning genetic control of enzyme and virus synthesis.

Jacob, Francois, b.—June 17, 1920, Nancy, France. A biologist who, together with Andre Lwoff and Jacques Monod, won the prize for their discoveries concerning genetic regulatory activities in bacteria.

Jacob received his M.D. degree from Paris in 1947. Most of the work of Jacob, Lwoff, and Monod was carried out at the Pasteur Institute, where Jacob had joined as a research worker in 1950. In 1960 he became head of the department of cellular genetics at the institute, and four years later he became the professor of cellular genetics at the College de France.

JACOB, FRANCOIS
France

With a co-worker at the Pasteur Institute, Jacob discovered that the genes of a bacterium are arranged in a linear ring and that the ring can be broken at almost any point. In 1958 Monod and Jacob began to collaborate in studies of the regulation of enzyme synthesis by bacteria. One of their first major contributions was the discovery of "regular genes", so called because they control the activities of structural genes. The latter, in turn, not only transmit hereditary characteristics from generation to generation but also serve in the production of enzymes, proteins, and ribonucleic acid (RNA).

Jacob and Monod also envisaged the existence of an RNA messenger, a partial copy of the gene substance deoxyribonucleic acid (DNA) that carries genetic information to other parts of the cell. They also found that in a normal cell the balance between regulator and structural genes enables the cell to adopt to varying conditions. An interruption in this balance, however, can stimulate the production of new enzymes that can prove either beneficial or destructive to the cell itself.

In 1947 Jacob married the pianist Lise Bloch and they have four children.

◆

For their discoveries concerning genetic control of enzyme and virus synthesis.

Lwoff, Andre, b.—May 8, 1902. Aulnay-le Chateau, France. He joined the Institut Pasteur at the age of 19 and completed his studies while working in the Laboratory. Lwoff obtained his M.D. in 1927 and Ph.D. in 1932. During 1932-33, he worked in Heidelberg in the laboratory of Otto Meyerhof (Nobel Laureate) on a Rockefeller

LWOFF, ANDRE
France

Foundation Grant. Lwoff was appointed Head of the Department of Microbiology at the Institut Pasteur in 1938, and professor of microbiology at the Science Faculty in Paris in 1959.

Lwoff showed that, after infection, the viral DNA passed on to succeeding generations of bacteria, called the lysogenic bacteria. He also demonstrated that under certain conditions the virus, which he called a prophage, gives rise to an infective form which disrupts the bacterial cell. The viruses that are released are capable of infecting other bacterial hosts. Lwoff also discovered extranuclear inheritance of certain traits in protozoans and demonstrated that vitamins function as coenzymes.

◆

For their discoveries concerning genetic control of enzyme and virus synthesis.

Monod, Jacques, b.—February 9, 1910, Paris. Monod spent his early years in the South of France, where his parents settled down when he was seven years old. His father was a painter.

Monod moved to Paris in 1928 for his higher education and obtained his science degree in 1931, and his doctorate in natural sciences in 1941. In 1936, Monod joined the Institut Pasteur as Laboratory Director, he became Director of its Cell Biochemistry Department in 1954. In 1967 he became professor at the College de France, and in 1971 he was appointed Director of the Institut Pasteur.

MONOD, JACQUES
France

He along with Francois Jacob, did much to elucidate the way in which genes regulate cell metabolism by directing the biosynthesis of enzymes. In 1961 they proposed the existence of messenger ribonucleic acid (RNA), a substance whose base sequence is complementary to that of DNA in the cell. In advancing the concept of gene complexes that they called "operons" they postulated the existence of a class of genes which regulate the function of other genes by affecting the synthesis of the messenger RNA.

In 1938, Monod married Golette Bruhl. They have twin sons. Monod's favourite recreations are music and sailing.

Note: The 1965 prize was awarded jointly to Jacob, Lwoff and Monod.

Literature

For the artistic power and integrity with which, in his epic of the Don, he has given expression to a historic phase in the life of the Russian people.

Solochov, Michail Aleksandrovic, b.—May 24, 1905, Veshenskaya, Rostov district Russia, d.—February 21, 1984, Moscow. A novelist, he joined the Red Army in 1920 and spent two years in Moscow.He returned to his native Cossack village in the Don region of Southern Russia. He made several trips to Western Europe and in 1959 accompanied Nikita Krushchev to the USA. He began writing in his early youth. His first novel was *Donskie rasakazy* (1926, Tales of the Don, 1961), containing a collection of short stories. In 1925, he began work on his novel *Tikhy Don* (The Silent Don), it took him twelve years to publish it in four volumes (1928-40). It was translated in two parts into English with the titles *And Quiet Flows the Don* (1934) and *The Don flows Home to the Sea* (1940). It took him 28 years to complete his other major novel, *Podnyataya tselina* (1932-60), it was also translated in two parts into English: *Virgin Soil Upturned* (1935) and *Harvest on the Don* (1960).

Tikhy Don became one of the most widely read novels in Russia and was regarded as the most powerful example of the reality of socialism. From May 1943 to February 1944, *Pravda* published excerpts from his new novel *They Fought for Their*

Country. In 1957, his story *Sudha Cheloveka* (The Fate of a Man) was made into a successful film.

SOLOCHOV, MICHAIL ALEKSANDROVIC
USSR

He was a member of the Soviet Academy of Sciences and was also awarded the Stalin and Lenin prizes.

Peace

UNITED NATIONS CHILDREN'S FUND (UNICEF)

New York

United Nations Chidren's Fund (UNICEF). It is a special body of the UNO devoted to aiding national efforts to improve the health, nutrition, education and general welfare of children. The body was established in December 1946 and was at that time known as the United Nations Children's Emergency Fund. It is still called the UNICEF to provide relief to children in countries devastated by war.

After 1950, when the post-war emergency was over, its efforts were diverted to the general programme for improvement of children's welfare, particularly of those in underdeveloped countries. Its activities are financed by the members of the UNO as well as by private charities. It arranges international programme for training of paediatricians for the prevention of children's diseases. The annual sale of its charity greeting cards and stationery has reached enormous proportions and has become very helpful for its smooth running.

1966

PHYSICS
Kastler, Alfred
CHEMISTRY
Mulliken, Robert S.
PHYSIOLOGY OR MEDICINE
Huggins, Charles Brenton / Rous, Peyton
LITERATURE
Agnon, Shmuel Yosef / Sachs, Nelly

1966

Physics

For the discovery and development of optical methods for studying Hertzian resonances in atoms.

Kastler, Alfred, b.—May 3, 1902, Guebwiller, formerly in Germany, now in France, d.—1984. His discovery and development of methods for observing Hertzian resonances within atoms threw new light on atomic structure. Some practical results of his work were the development of the "maser" and "laser" and a new method for measuring weak magnetic fields.

KASTLER, ALFRED
France

In 1920, he went to Paris to study at the Ecole Normale Superieure and after serving on the science faculties at Bordeaux and Clermont Ferrand in France and Louvain in Belgium, he returned to the Ecole Normale Superieure in 1941 to teach. He was professor and codirector of the laboratory of physics there when he received the prize. In 1950 he developed the "Optical Pumping System" by means of which atoms were illuminated with frequencies of light, which were absorbed. These excited atoms thus produced a population inversion and then emitted highly coherent and monochromatic radiations on de-excitation. This technique helped in the development of "lasers" and "masers".

Chemistry

For his fundamental work concerning chemical bonds and the electronic structure of molecules by the molecular orbital method.

Mulliken, Robert S., b.—June 7, 1896, Newburyport, Massachusetts. A chemist as well as a physicist who received the prize for his researches on chemical bonds and the electronic structure of molecules.

MULLIKEN, ROBERT S.
USA

He graduated from the Massachusetts Institute of Technology and worked in Government Chemical Research during World War I. He was a student of the Nobel Laureate physicist Robert A. Millikan at the University of Chicago. He was on the faculty of the New York and the Chicago Universities. He started his work on the theory of molecular structure in 1920. In 1952, he developed a quantum-mechanical theory on the behaviours of electron orbitals as different atoms merge to form molecules. During World War II he worked on the plutonium project for the first atomic bomb. He served in the diplomatic service as a scientific attache in the US Embassy, London. He joined the Institute of Molecular Biophysics at the Florida State University, Tallahassee, in 1965.

Physiology or Medicine

For his discoveries concerning hormonal treatment of prostatic cancer.

Huggins, Charles Brenton, b.—September 22, 1901, Halifax, Canada. A surgeon and medical researcher born in Canada, whose demonstration of the fact that the injection of a synthetic female sex hormone causes the disappearance of tumours in the prostate glands of males. He established the feasibility of hormonal therapy in the control of cancer. He was educated at Nova Scotia and later at the Harvard Medical School. He became a US citizen where he conducted his Nobel Prize winning research.

HUGGINS, CHARLES BRENTON
Canada/USA

◆

For his discovery of tumorinducing viruses.

Rous, Peyton, b.—October 5, 1879, Baltimore, Maryland, d.—February 16, 1970, New York City. Rous studied medicine at Johns Hopkins Medical School in Baltimore. He gave up the study of clinical medicine to study pathology at Ann Arbor, Michigan. He had to give up studies temporarily due to tuberculous infection. The Director of Rockefeller Institute, Simon Flexner, gave Rous an opportunity to work on cancer. He spent almost all his working life at the Rockefeller Institute which is now known as Rockefeller University.

ROUS, PEYTON
USA

A tumour occurring spontaneously in a Plymouth Rock fowl was successfully transplanted in series by means of cell-grafts and this proved to be a sarcoma. Rous succeeded in passing the sarcoma by grafts as well as by means of cell-free filtrates. He, amidst a lot of disbelief and disagreement, proved that cancer could be transplanted from one fowl to another. The transplanted growth carried a virus of cancer into the body of the recipient. Scepticism, however, remained, and Rous, not a little discouraged, turned for a time to other fields. His epoch-making finding was not recognised until the new discoveries in molecular biology and the explanation of the mechanism of heredity emphasized the theory of viral origin of cancer.

During World War II, Rous, along with J.R. Turner and O.H. Roberston, discovered a way of preserving red blood cells, which ultimately helped in stocking of blood for transfusions. As a result, the world's first blood bank was opened in Belgium. Further work involved the studies of blood pigments and their fate which led to research on the liver and gall-bladder with special reference to bile pigments.

In the 1930s Rous turned his attention once again to cancer. He studied in detail the changes that take place when a simple wart in rabbits acquires the properties of a malignant growth. He showed that virus and carcinogenic chemicals, by their combined action, could cause cancer more quickly than by either agent acting alone. His work helped in the better understanding of the mysteries about cancer, especially how cells rendered cancerous could fail to reveal themselves until some promoting agent is operated.

Rous, after retirement in 1945, continued working at the Rockefeller Institute and published several scientific papers.

Rous was editor of the *Journal of Experimental Medicine* for 46 years. He was elected a Foreign Fellow of the Royal Society in 1940.

Rous married in 1915 and had three daughters.

Note: The 1966 prize was awarded jointly to Huggins and Rous.

Literature

For his profoundly characteristic narrative art with motifs from the life of the Jewish people.

Agnon, Shmuel Yosef, b.—July 17, 1888, Buczacz, Galicia, Poland, d.—February 17, 1970, Jerusalem. He is considered to be the greatest of modern Hebrew novelists and short story writers. He was born in a family of Polish Jewish merchants and scholars.

AGNON, SHMUEL YOSEF
Poland/Israel

He wrote first in Yiddish and Hebrew (1903-6) under his own name and various pseudonyms but soon after his settlement in Palestine in 1907, he adopted the surname of Agnon and chose the Biblical language for his dramatic, visionary, and highly polished narratives. His literary pursuit began with *Agunot* (1908, Forsaken Wives), a true Palestinian story. His first major novel was *Hallkhnasat Kallah* (in 2 volumes, 1922, The Bridal Canopy, 1937). It deals with the lives of the wandering Jews living in the ghettos of the Tsarist and Austro-Hungarian monarchies. His second novel *Oreach Nata Lalun* (1938, A Guest for the Night, 1968) describes the moral decay of European Jews after World War I. His third and the greatest novel, *Tmol Shilshom* (1945, The Day Before Yesterday) tackles the problem of the westernized Jews and their acclimatization to the mental, moral and material climate of Israel.

He published an autobiographical novel in 1958 and scores of stories in collected volumes. He received an honorary doctorate in 1958 from the University of Jerusalem. He is the first writer in Hebrew to receive the prize.

◆

For her outstanding lyrical and dramatic writings, which interpret Israel's destiny with touching strength.

Sachs, Nelly, b.—December 10, 1891, Berlin, d.—May 2, 1970, Stockholm. A poet and dramatist who was transformed by the Nazi atrocities from a dilettante to a poignant speaker for the grief and yearnings of her tortured fellow Jews. She was the daughter of a prosperous manufacturer and inventor and grew up in an exclusive atmosphere in the fashionable Tiergarten district of Berlin. She learned to dance well and she was deft in puppetry.

She took to writing at the age of only 17 years. In 1921, *Legenden und Erzaelungen* (Legends and Stories) was followed by some poems in the newspapers.

The cruelty of Nazism darkened her life and she took to ancient Jewish writings. In 1940, she fled from Germany to escape her certain detention in a Nazi concentration camp. She reached Sweden with the help of her penfriend, the Swedish Nobel Laureate novelist Selma Lagerloef, who exerted her influence on the Swedish Royal household to help Sachs' naturalization as

SACHS, NELLY
Germany/Sweden

a Swedish citizen. She lived with her aging mother in a one-room tenement and translated German poetry into Swedish after learning Swedish.

In 1947, a collection of poems entitled *In den Wohnungen des Todes* (In the Habitations of Death); appeared in Berlin, and was followed by *Sternverdunkelung* (Eclipse of the Stars, 1949), *Und niemand weiss weiter* (And No One Knows How to Go On, 1957), *Flucht und Verwandlung* (Flight and Metamorphosis, 1958), *Fahrt ins Staublose* (Journey into a Dustless Realm, 1961) and a collection of plays, *Zeichen im Sand* (Signs in the Sand, 1962). Her lyrics in those years were simple, tender, searing and mystical. Her famous *O die Schornsteine* (Oh the Chimneys), in which Israel's body symbolically drifts in smoke from the Nazi death chambers, was selected as the title poem of a collection of her work translated into English.

In 1965, she received the peace prize of the German publishers. In accepting the award she said, "In spite of all the horrors of the past, I believe in you" that shows her greatness and deep love for Germany.

Note: The 1966 prize was awarded jointly to Agnon and Sachs.

1967

PHYSICS

Bethe, Hans Albrecht

CHEMISTRY

Eigen, Manfred
Norrish, Ronald George Wreyford
Porter, Sir George

PHYSIOLOGY OR MEDICINE

Granit, Ragnar
Hartline, Haldan Keffer / Wald, George

LITERATURE

Asturias, Miguel Angel

1967

Physics

For his contributions to the theory of the nuclear reactions, especially his discoveries concerning the energy production in stars.

Bethe, Hans Albrecht, b.—July 2, 1906, Strassburg, Germany. A theoretical physicist, Bethe received his doctorate in 1928 from the University of Munich and taught physics at Munich and Tubingen till 1933. Later he joined the physics faculty of Cornell University, New York, in 1934. He worked under great physicists like Summerfield, Rutherford and Fermi. His main contribution to science was his researches on the nuclear mechanisms that are responsible in the energy production in stars. He served as director of the theoretical division of the atomic bomb "Manhattan Project" in Los Alamos, New Mexico, and after World War II, lectured on the threat of nuclear weapons to world peace and the need for control of atomic proliferation. In 1954, he was elected president of the American Physical Society. Many of Bethe's contributions to theoretical physics are related to electron densities in crystals, nuclear structure, solid state, nuclear reactor theory, and shock waves. In 1961 Bethe was honoured with the 'Fermi award' .

BETHE, HANS ALBRECHT
USA

He married Rose Ewald in 1939; they have one son.

Chemistry

For their studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy.

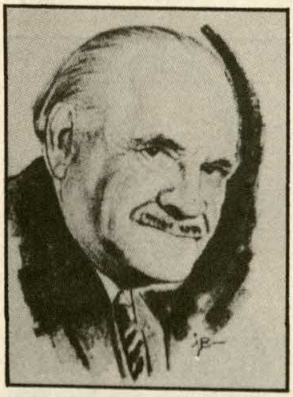
Eigen, Manfred, b.—May 9, 1927, Bochum, now in West Germany. Eigen, the son of a musician, was educated at the University of Göttingen where he obtained his Ph.D. in 1951. He joined the staff of the Max Planck Institute for Physical Chemistry at Göttingen in 1953 and has served as its director since 1964. In 1954 Eigen introduced the so-called relaxation techniques for the study of extremely fast chemical reactions (those

EIGEN, MANFRED
West Germany

taking less than a millisecond). Eigen's general method was to take a solution in equilibrium for a given temperature and pressure. If a short disturbance was applied to the solution the equilibrium would be very briefly destroyed and a new equilibrium quickly reached. Eigen studied exactly what happened in this very short time by means of absorption spectroscopy. He applied disturbances to the equilibrium by a variety of methods, such as pulses of electric current, sudden changes in temperature of pressure or changes in electric field. The first reaction he investigated was the apparently simple formation of a water molecule from the hydrogen ion, H, and the hydroxide ion, OH^-. Calculations of reaction rates made it clear that they could not be produced by the collision of the simple ions H and OH. Eigen went on to show that the reacting ions are the unexpectedly large H_9O_4 and H_7O_4 a proton hydrated with four water molecules and a hydroxyl ion with three water molecules. Eigen later applied his relaxation techniques to complex biochemical reactions. He has also become interested in the origin of nucleic acids and proteins. With his colleague R. Winkler he has proposed a possible mechanism to explain their formation.

◆

For their studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy.



NORRISH, RONALD GEORGE WREYFORD
Great Britain

Norrish, Ronald George Wreyford, b.—November 9, 1897, Cambridge, England, d.—June 7, 1978. Pioneer of flash photolysis and kinetic spectroscopy.

Norrish was educated at the Perse School, Cambridge, and went on to read chemistry there at Emmanuel College. His studies were interrupted by military service in the First World War, during which he became a prisoner of war. Afterwards he returned to Cambridge as Demonstrator (1925), Lecturer (1930), and finally, Professor of Physical Chemistry (1937), until his retirement in 1965.

Norrish's life work was in reaction kinetics, with a particular interest in photochemical reactions. From 1945 he developed, with (Sir) George Porter a new technique of flash photolysis, and for this they were jointly awarded a Nobel Prize for chemistry in 1967. In this, a chemical reaction is initiated by an exceedingly intense flash of light, around 600,000 kilowatts, which creates a number of short-lived radicals. The nature of these is investigated spectroscopically by means of a weaker flash following close on the first. By this means, it has been possible to investigate the kinetics and energetics of reactions taking place in as little as a ten billionth of a second.

Norrish was honoured by many foreign scientific societies. In Britain, the Royal Society elected him to Fellowship in 1936.

◆

For their studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy.

PORTER, Sir GEORGE
Great Britain

Porter, Sir George, b.—December 6, 1920, Stainforth, Yorkshire. A British chemist who was educated at Thorne Grammar School, Leeds University and Emmanuel College, Cambridge. He did his war service with the R.N.V.R. After the war he became a demonstrator of physical chemistry at Cambridge University (1949-52), where he became Assistant Director of Research (1952-54). He joined the University of Sheffield in 1955 and worked until 1963. From 1963 to 1966 he was also professor of chemistry at the Royal Institution, London and was appointed its director in 1966.

He and Ronald Norrish developed the new technique of flash photolysis to initiate and record very fast chemical reactions. For this achievement he shared the Nobel Prize for Chemistry in 1967 with Ronald Norrish and Manfred Eigen of Germany. His publications include *Chemistry for the Modern World* (1962), *Laws of Disorder* (1965), *Time Machines* (1969-70)

Note: The 1967 prize was awarded jointly one-half to Eigen, and other half to Norrish and Porter.

Physiology or Medicine

For their discoveries concerning the primary physiological and chemical visual processes in the eye.

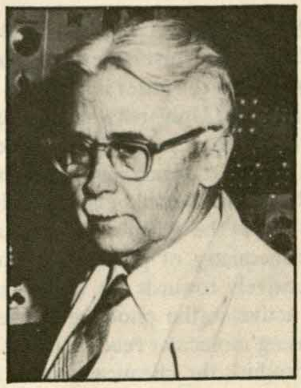
Granit, Ragnar, b.—October 30, 1900, Helsinki, Finland. He graduated from the Swedish Normal Lyceum in Helsinki University in 1927. He held a teaching position there from 1929 to 1937. During this period he spent two years as a Fellow in Medical Physics at the Eldrige Reeves Johnson Research Foundation at the University of Pennsylvania. He also spent two years studying neurophysiology under Sir Charles Sherrington (Nobel Laureate) at Oxford. In 1940 Granit joined the Royal Caroline Institute of Stockholm, Sweden, and was made its director in 1945. Since 1956 he has been a visiting professor on the staff of Rockefeller University, New York. He was the Thomas Young Orator for the Physical Society in London in 1945 and Silliman Lecturer at Yale University in 1956. He holds awards and honorary degrees from a number of universities. He impressed the neurophysiologists in 1945 by his demonstration that single nerve fibres from the retina were differentially sensitive to different wave lengths of light.

GRANIT, RAGNAR
Sweden

◆

For their discoveries concerning the primary physiological and chemical visual processes in the eye.

Hartline, Haldan Keffer, b.—December 22, 1903, Bloomsburg, Pennsylvania. He was the first neurophysiologist to record the activity of a single visual receptor centre and devised a means of intercepting and recording the electrical signal sent by a single isolated nerve fibre when receptors are stimulated by light. He received his B.Sc. degree from Lafayette College and the Doctor of Medicine degree from Johns Hopkins University in 1927. He studied physics at the universities of Leipzig and Munich as a Johnson Travelling Research Scholar. He also served as a National Research Council Fellow at Johns Hopkins University from 1927 to 1929. From 1931 to 1936 he was a Johnson Fellow in medical physics. He was



HARTLINE, HALDAN KEFFER
USA

associated with University of Pennsylvania's Eldrige Reeves Johnson Research Foundation. During 1949 and 1953 he was the professor and chairman of the Jenkins Department of Biophysics at Johns Hopkins University. Before he joined the Rockefeller University in 1953 he held teaching positions at Cornell University Medical College and University of Pennsylvania.

◆

For their discoveries concerning the primary physiological and chemical visual processes in the eye.

Wald, George, b.—November 18, 1906, New York. A biochemist, he was educated in New York and Columbia Universities and received the Ph.D. degree from the latter in 1932. In 1934, he joined the Harvard University and was appointed Professor of Biology in 1948. He received his training in Berlin, Zuerich and Heidelberg on a National Research Council Fellowship. He is recognized as one of the world's greatest authorities on the biochemistry of perception. He contributed extensively towards the understanding of how light activates the photo-receptive cells in retina, causing molecular readjustments. He was able to reproduce the chemical process of vision *in vitro*. The recognition of his above researches on human vision came through awards like the Eli Lilly Research award (1939), Lasker award (1953), the Proctor medal (1955), the Ramford medal and Premium of the American Academy of Arts and Sciences (1959). He holds a number of honorary degrees from various universities of the world.

WALD, GEORGE
USA

Note: The 1967 prize was awarded jointly to Granit, Hartline and Wald.

Literature

For his vivid literary achievement, deep-rooted in the national traits and traditions of Indian peoples of Latin America.

Asturias, Miguel Angel, b.— October 19, 1899, Guatemala City, Central America, d.—June 9, 1974, Madrid. A poet, novelist, and a diplomat. His writings combine the mysticism of the Mayas with an epic impulse towards social protest against the injustice done to the Indians of Central America. He received a degree in law from the University of Guatemala in 1923 and settled in Paris, where he studied ethnology at the Sorbonne.

ASTURIAS, MIGUEL ANGEL
Guatemala

During his Parisian sojourn he came under the influence of the French novelist and literary theorist Andre Breton. His first major work was *Leyendas de Guatemala* (1930, Legends of Guatemala) which described the life and culture of the Mayas before the arrival of the Spanish Conquistadoros. On his return to Guatemala he founded and edited *El diario del aire* (a radio magazine). He published several volumes of poetry, beginning with *Sonetos* (1936, Sonnets).

In 1946, he entered the diplomatic service of Guatemala but continued to write while serving at various places in Central and South America. His talent as a novelist was revealed during this period when he published *El senor presidente* (1946, The President, 1963) and *In Hombres de maiz* (1949, Men of the Corn) which were followed by his triology of novels, *Viento fuerte*

(1950, The Cyclone, 1967), *El papa verde*, (1954, The Green Pope, 1971) and *Los ojos de los enterados* (1960, The Eyes of the Interred, 1973).

From 1966 to 1970 he served as the Guatemalan Ambassador to France, where he took up permanent residence after retirement. He received the Lenin Peace prize in 1966.

1968

PHYSICS

Alvarez, Luis W.

CHEMISTRY

Onsager, Lars

PHYSIOLOGY OR MEDICINE

Holley, Robert W. / Khorana, Har Gobind
Nirenberg, Marshall W.

LITERATURE

Kawabata, Yasunari

PEACE

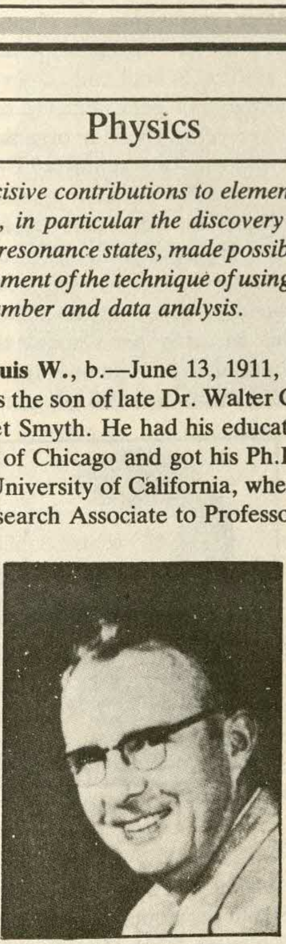
Cassin, René

1968

Physics

For his decisive contributions to elementary particle physics, in particular the discovery of a large number of resonance states, made possible through his development of the technique of using hydrogen bubble chamber and data analysis.

Alvarez, Luis W., b.—June 13, 1911, San Francisco. He is the son of late Dr. Walter C. Alvarez and Harriet Smyth. He had his education in the University of Chicago and got his Ph.D. in 1936 from the University of California, where he rose from a Research Associate to Professor.



ALVAREZ, LUIS W.
USA

Alvarez discovered that some radioactive elements decay by orbital-electron capture, i.e. an orbital electron merges with its nucleus, producing an element with an atomic number smaller by one. He and the Nobel Laureate Bloch for the first time measured the strength and direction of its magnetic field.

Alvarez, working on radar at the Radiation Laboratory of Massachusetts Institute of Technology, developed microwave beacons, linear radar antennas, and the ground-controlled landing approach system for aircrafts, a method for blind bombing with the use of radar located enemy targets. He was engaged in atomic research at the Los Alamos Scientific Laboratory, and suggested the technique for detonating the implosion type of atomic bomb.

After World War II, Alvarez helped to construct the first proton linear accelerator and developed the hydrogen bubble chamber, a device used to detect subatomic particles and their reactions. This work led physicists to the discovery of 60 to 100 new elementary particles and to a major revision of nuclear theory.

Alvarez is the recipient of many awards and medals. He has also received honorary doctorates from many universities. His publications include more than 100 scientific papers. In addition to these he has 22 US patents, largely in electronics and optics.

Alvarez is fond of flying, golf and music.

Chemistry

For the discovery of the reciprocal relations bearing his name, which are fundamental for the thermodynamics of irreversible processes.

Onsager, Lars, b.—November 27, 1903, in former Kristiania, now Oslo, Norway, d.—October 5, 1976, Coral Gables, Florida. Onsager was the son of a lawyer. After a liberal education he entered the *Norges Tekniske Wogskole*, Trondheim in 1920 to study chemical engineering. His early work in statistical mechanics attracted the attention of the Dutch Nobel Laureate Peter Debye, under whose direction Onsager studied at the Swiss Federal Institute of Technology in Zürich. He then went to the USA, where he remained for the rest of his life, and taught at the Johns

Hopkins University, Baltimore, and Brown University, Providence, Rhode Island. He received his Ph.D. from Yale University where he became a Sterling and Gibbs Fellow and in 1945 was appointed Professor of Theoretical Chemistry there, which position he held until his retirement in 1973. He was offered a Distinguished Professorship in the University of Miami.

In 1923 Debye and E. Huckel published a theory which was based on a statistical analysis of a system in which each ion is surrounded by a cloud of ions of opposite charge. The "Debye-Huckel theory", as it is known now, was not wholly in agreement with experimental observations for strong solutions, but Onsager discovered that much closer correlation was possible if account was taken of the Brownian motion of the ion. Onsager introduced himself to Debye and said simply: "Professor Debye, your theory of electrolytes is incorrect." Debye who was convinced and impressed offered him an assistantship.

ONSAGER, LARS
Norway and USA

While at Brown, Onsager formulated his theory of Reciprocal Relations in irreversible processes, commonly known as the Fourth Law of Thermodynamics. His explanation of the movement of ions in solution as related to turbulences and fluid densities had an important effect on the development of physical chemistry. His work was based on solutions of strong electrolytes and on the quantization of vortexes in liquid helium.

Onsager's brilliance amounted to genius. He could solve with great ease theoretical problems of great complexity and he firmly believed that others could match him intellectually if only they tried hard enough.

Physiology or Medicine

For their interpretation of the genetic code and its function in protein synthesis.

Holley, Robert W., b.—January 28, 1922, Urbana, Illinois. After graduating in chemistry from Illinois University in 1942, Holley joined the team at Cornell Medical School that achieved the first artificial synthesis of penicillin. He remained at Cornell to receive his Ph.D. in organic chemistry in 1947. He spent two years (1955-56) at the California Institute of Technology which marked the beginning of his important research on the nucleic acids. He decided that to work out the structure of a nucleic acid one first needed a very pure specimen of the molecule. Back again at Cornell, his research team spent three years isolating one gram of alanine transfer RNA (alanine RNA) from some 90 kilograms of yeast.

HOLLEY, ROBERT W.
USA

In March 1965 he was able to announce that they had worked out the complete sequence of 77 nucleotides in alanine RNA. For this work Holley received the prize which he shared with Marshall Nirenberg and Har Gobind Khorana.

◆

For their interpretation of the genetic code and its function in protein synthesis.

Khorana, Har Gobind, b.—January 9, 1922, Raipur, Punjab (India) now in Pakistan. He is the youngest of a family of one daughter and four sons. His father was a *Patwari*.

He was educated at the DAV School, Multan, and studied chemistry at Lahore on a scholarship. He passed B.Sc. in 1943 and M.Sc. in 1945, both with honours. He joined the University of Liverpool on a Government of India Fellowship from where he obtained his Ph.D. in chemistry in 1948. As a post-doctoral fellow he worked in the Federal Institute of Technology at Zuerich.

KHORANA, HAR GOBIND
India and USA

Khorana spent a post-doctoral year (1948-49) at the Eidgenossiche Technische Hochschule in Zürich with professor Vladimir Prelog. The association with professor Prelog (Nobel Laureate) had a tremendous influence on him and his approach to science. After a brief period in India in the fall of 1949, he returned to England on a Nuffield Fellowship at the Cambridge University, where he worked under Sir Alexander Todd (Nobel Laureate). He then went to Vancouver and joined the University of British Columbia. He joined the University of Wisconsin in 1960.

He succeeded in synthesizing the first wholly artificial gene.

Khorana married Esther Elizabeth Sibber, of Swiss origin, in 1952. They have three children. He is a naturalized citizen of the United States.

◆

For their interpretation of the genetic code and its function in protein synthesis.

Nirenberg, Marshall W., b.—April 10, 1927, New York City. Nirenberg received B.Sc. degree in 1948, M.Sc. in Zoology in 1952 and Ph.D. in Biochemistry in 1957 from the University of Florida.

In 1959 he began to study the steps that relate DNA, RNA and protein. He demonstrated that RNA is required for protein synthesis and that its preparations can be used to decipher various aspects of the genetic code.

NIRENBERG, MARSHALL W.
USA

Nirenberg played a major role in deciphering the genetic code.

Nirenberg married Perola Zaltyman, a chemist from the University of Brazil, in 1961.

Note: The 1966 prize was awarded jointly to Holley, Khorana and Nirenberg.

Literature

For his narrative mastery, which with great sensibility expresses the essence of the Japanese mind.

KAWABATA, YASUNARI
Japan

Kawabata, Yasunari, b.—June 11, 1899, Usaka. d.—April 17, 1972, Zushi City. A novelist whose melancholic lyricism echoes in the modern idiom an ancient Japanese literary tradition. He was orphaned in infancy. Because of a lonely childhood and many deaths in the family, melancholy permeated his writing.

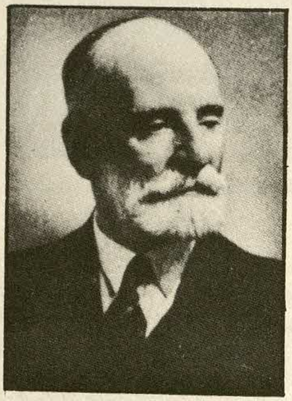
He entered the literary world with *Izu no Oderike* (1926, The Izu Dancer, 1955) a semi-autobiographical story of the association of a young student and a travelling dancing girl. It was published after his graduation from the University of Tokyo and came out in the journal *Bungei Jidai* (The Artistic Age) which was started by the writer Yokomitsu Ritchi. The journal became the organ of the neo-impressionist school in Japan. The earlier works like *Suisho Genso* (Crystal Vision, 1931) and *Asakusa Kurendaiden* (The Scarlet Gang of Asakusa, 1929-35) were influenced by European models but, his best known novel, *Yukiguni* (English, 1957), is the story of a romance between a country geisha and an elderly city intellectual; it was completed in 12 years. His next novel *Sembazuru* (Thousand Cranes, 1959) was followed by *Yama no oto* (1949-54, The Sound of the Mountain, 1970), *House of the Sleeping Beauties* (1961) and *Kyoto* (Kyoto, 1962) which received special mention by the Nobel Committee.

His chronic melancholy gradually overpowered him and in 1972, he committed suicide by inhaling gas from a bathroom water heater.

Peace

Cassin, René, b.—1887 in Bayonne, France, d.—1976. French jurist, statesman. Cassin studied literature and law in Aix-en-Provence and Paris. He was called to the bar in 1909, while continuing his studies preparatory to an academic career. Cassin's University career was interrupted by World War I. He fought in the infantry and was severely wounded, being awarded the Croix de Guerré and the Medaille Militaire. In 1920, Cassin was appointed professor of law at Lille and in 1929 at Paris, where he continued to teach until 1960. In addition, he taught at the Academy of International Law of The Hague, and at the *Institut Universitaire des Hautes Etudes Internationales* of Geneva, among other places.

Cassin, who had a passion for justice as well as being a jurist and educator, was also a man of action and devoted himself to social problems and human rights. He helped to found the first war invalids associations in France and to coordinate their efforts in the *Union Federale des Anciens Combattants*, of which he became president in 1922. In this capacity, he was concerned in the education of 800,000 French war orphans and in organizing action for peace. Representing France from 1924 at the League of Nations and later at the United Nations and UNESCO, Cassin collaborated in the elaboration of a new legal system to counteract war and further the progress of civilization.



CASSIN, RENÉ
France

During World War II several members of his family were murdered by the Germans (as Cassin was of Jewish extraction). He was one of the first civilians in high positions to respond to the call for resistance by General de Gaulle in June 1940. He found his way to London, and drew up the agreements between Churchill and de Gaulle which defined the status of the Free French Forces. In his broadcasts from the BBC, he restored the courage of his fellow countrymen and lent his gifts as a jurist to de Gaulle in the work of liberation and reorganization of France from the chaos of defeat. As a member of the *Comité National Francais*, Cassin presided over the first Free French study commissions, and became national commissioner for justice and education in the French government in London (1941-43); a member of the consultative assembly in Algiers, and president of the judicial committee. After Cassin returned to France, he held high positions in the state, becoming vice-president of the *Conseil d'Etat* (1944-60), president of the *Ecolé Nationale d' Administration* and the *Cour Supreme d' Arbitrage* (1945-60) and in 1960, member of the *Conseil Constitutionnel*. He also served as president of the *Academie des Sciences Morales et Politiques*, of which he was a member from 1947. In the international sphere, Cassin served from 1946 as a member and president of the United Nations Commission of Human Rights. In this capacity, he was one of the initiators and the principal draftsman of the Universal Declaration of Human Rights. It was largely due to Cassin's skilled diplomacy that the text was adopted in Paris in December 1948.

While striving for the establishment and consolidation of the United Nations, Cassin also contributed to the organization of a United Europe. He served as president of the European Court of Human Rights, of the Society of Comparative Legislation of the International Institute of Administrative Sciences, of the Committee of Foreign Legislation and International Law, and of the International Institute of Diplomatic Studies. In 1943, General de Gaulle entrusted to Cassin the direction of the *Alliance Israelite Universelle*, when its central committee ceased to function in Vichy France. As its president, he took part in the rehabilitation of contemporary Jewry, reorganized its work, and developed its educational and cultural activities in France, the free world, the Muslim countries, and Israel. Cassin also became honorary president of the World *Sephardi* (Oriental Jewry) Federation. Cassin is the author of numerous books. He has been awarded the highest French and foreign honors. The United Nations awarded him one of the six prizes in the sphere of Human Rights.

1969

PHYSICS

Gell-Mann, Murray

CHEMISTRY

Barton, Sir Derek H.R. / Hassel Odd

PHYSIOLOGY OR MEDICINE

Delbruck, Max / Hershey, Alfred D.
Luria, Salvador E.

LITERATURE

Beckett, Samuel

PEACE

International Labour Organization (ILO)

ECONOMIC SCIENCES

Frisch, Ragnar / Tinbergen, Jan

1969

Physics

For his contributions and discoveries concerning the classification of elementary particles and their interactions.

Gell-Mann, Murray, b.—September 15, 1929, New York City. A winner of the prize for his work in bringing order to the knowledge of the seemingly confusing profusion of subatomic particles. He entered the Yale University at the age of 15, received his Bachelor's degree in 1948 and his Ph.D. from the Massachusetts Institute of Technology in 1951. His doctoral research on the intermediate coupling problem of subatomic particles was influential in the later work of the 1963 Nobel laureate Eugene P. Wigner.

In 1952, Gell-Mann joined the Institute for Nuclear Studies at the University of Chicago and worked under Fermi. The following year he introduced the concept of "strangeness", a property that accounted for previously puzzling decay patterns of certain nuclear particles. With the assignment of a strangeness quantum number and a corresponding conservation law, there arose new interest in bringing order to the confused multiplicity of nuclear particles.

GELL-MANN, MURRAY
USA

In 1955, he joined the staff of the California Institute of Technology, Pasadena, and six years later he announced his "Eightfold Way", named after Lord Buddha's Eightfold path of virtues that enable man to attain harmony in life. The Eightfold Way is a system for grouping all particles into a simple, orderly arrangement of families which evoke comparisons with the periodic table. Like the original periodic table, the Eightfold Way had gaps in it, and Gell-Mann predicted the existence of new particles with properties to fit in the gaps. In 1964, after three years of failure, the "Omega-minus" particle was discovered which completed a major family and gained general acceptance of the Eightfold Way among other physicists. A further development of this theory is Gell-Mann's theory of "quarks". An hypothetical group of particles with fractional electrical charges which may be the basic building blocks from which all subatomic particles, and thus all matter in the universe are formed.

Chemistry

For their contributions to the development of the concept of conformation and its application in chemistry.

Barton, Sir Derek H.R., b.—September 8, 1918, Gravesend, Kent. The joint recipient, with Odd Hassel of Norway, of the prize for research that helped to establish conformational analysis as an essential part of organic chemistry. In 1945 Barton joined the staff of the Imperial College of Science and Technology, London, first as assistant lecturer and later as a research fellow. While serving

BARTON, Sir DEREK H.R.
Great Britain

as a visiting professor at Harvard University in 1949-50, he began his work on the problem of the behaviour of certain organic compounds. In a paper on conformational analysis published in 1950 he immediately caught the attention of the scientific community and revolutionized organic chemistry. He was a faculty member of Birkbeck College, University of London. He served as professor of chemistry at the University of Glasgow, Scotland, and then became professor of organic chemistry at Imperial College of Science. In 1960, he discovered the "Barton reaction", a process that led to an easier means of synthesizing the hormone aldosterone. ◇

For their contributions to the development of the concept of conformation and its application in chemistry.

HASSEL, ODD
Norway

Hassel, Odd, b.—May 17, 1897, Oslo. A Norwegian physical chemist, he established the conformational analysis as an important force in changing the modern concepts of molecular structure. He was on the faculty of the Oslo University in 1925 and became its director of physical chemistry in 1934.

He began research on the structure of cyclohexane and its derivative in 1930 and discovered two forms of cyclohexane. During World War II his works were obscured due to the German occupation of his country. Those works were later known to the scientists of the world after the cessation of hostility. Since 1950, he was engaged in the study of organic halogen compounds. He retired in 1964.

Note: The 1969 prize was awarded jointly to Barton and Hassel.

Physiology or Medicine

For their discoveries concerning the replication mechanism and the genetic structure of viruses.

Delbruck, Max, b.—September 4, 1906, Berlin. A German born naturalized American physicist. His father was professor of history at the University of Berlin. He grew up in the suburb of Berlin amidst middle class academic, professional and merchant community.

Delbruck's interest in science started with astronomy. He was greatly influenced by Karl Friedrich, a physical chemist of distinction. He received his education at the University of Göttingen and his Ph.D. in physics from the same University in 1930. He worked as a Rockefeller Foundation Fellow in Copenhagen and Zuerich. He migrated to the USA with the same fellowship at the California Institute of Technology (1937-39). He served as an instructor in physics at the Vanderbilt University (1940-45), eventually becoming a professor in 1947.

Delbruck is renowned for his earlier work on quantum theory of chemical bond. From physics he switched over to molecular biology and developed a key method known as a plaque technique, which has become a basic method in the study of molecular biology today. With Salvador Luria he

DELBRUCK, MAX
Germany and USA

studied the interaction between the virus and the changes in the genetic character of bacteria. They discovered that mutation in bacteria could occur spontaneously, randomly and independently of the virus.

In 1941, Delbruck married Mary Bruce and they have four children. ◇

For their discoveries concerning the replication mechanism and the genetic structure of viruses.

Hershey, Alfred D., b.—December 4, 1908, Owosso, Michigan.

Hershey studied at the Michigan State College, from where he obtained B.S. in 1930 and Ph.D. in 1934. In 1967 the University of Chicago honoured him with the honorary D.Sc. During 1934-50 he was teaching and researching at the Bacteriology Department of Washington University School of Medicine. In 1950, he joined the staff of the Department of Genetics, Carnegie Institution, Washington, and in 1962, he was appointed Director of its Genetics Research Unit.

In 1945, Hershey and Luria, both working independently, demonstrated the occurrence of spontaneous mutation in both bacteriophage and its host. The next year, Hershey and Delbruck independently discovered the occurrence of genetic recombination in phages.

Hershey is most noted for the so-called "blendor experiment" which he performed with Martha Chase in 1952. They showed that DNA of phage is the principal component entering the host cell during infection. Hershey proved that DNA, rather protein, is the genetic material of the phage. For this discovery Hershey won the Albert Lasker Award in 1958 and in 1965 the Kimber Genetic Award.

HERSHEY, ALFRED D.
USA

Alfred Hershey married Harriet Davidson in 1945 and they have one son. Hershey is a member of the American Society for Microbiology, the National Academy of Sciences, and the American Academy of Arts and Sciences. ◇

For their discoveries concerning the replication mechanism and the genetic structure of viruses.

Luria, Salvador E., b.—August 13, 1912, Torino, Italy. Luria started his studies in Medicine at the University of Torino from where he obtained his M.D. in 1935. From 1938 to 1940 he was a Research Fellow at the Institute of Radium in Paris.

Luria went to the USA in 1940 after learning the techniques of phage research at the Pasteur Institute in Paris. Soon after his arrival, he met Delbruck, through whom he became involved with the American Phage Group, an informal scientific organization devoted to solving the problems of viral self-replication. Working with a member of the group in 1942, Luria obtained an electron micrograph of phage particles. The picture confirmed the earlier description of phage particles as consisting of a round head and a thin tail.

In 1943 Luria and Delbruck published a paper that refuted prevalent views in bacteriology. They showed that viruses undergo permanent changes in their hereditary material. Luria also proved that the simultaneous existence of phage-resistant bacteria with phage-sensitive bacteria in the same culture was the result of the selection of spontaneous bacterial mutants. In 1945, Hershey and Luria demonstrated the existence not only of spontaneous bacterial mutants but also of spontaneous phage mutants.

LURIA, SALVADOR E.
Italy/USA

The author of a college textbook, *General Virology* (1935), Luria became a Sedgwick professor of biology at the Massachusetts Institute of Technology, Cambridge, in 1965, after serving there as professor of microbiology from 1950 to 1958. He became a citizen of the USA in 1947. In 1945, he married Zella Hurwitz; they have one son.

Note: The 1969 prize was awarded jointly to Delbruck, Hershey and Luria.

Literature

For his writing, which—in new forms for the novel and drama—in the destitution of modern man acquires its elevation.

BECKETT, SAMUEL
Ireland

Beckett, Samuel, b.—April 13, 1906, Foxrock, Ireland. A writer of narrative prose, poetry, drama and criticism, whose works emphasized the transitoriness and insignificance of the human existence in modern universe. He obtained his B.A. degree from the Trinity College, Dublin, in 1927. He taught English in Paris where he met the literary refugees which included people like James Joyce.

He returned to Dublin in 1930 to teach French in the Trinity College. He published a verse called *Whoroscope* (1930) and *Echo's Bonus* in 1935 and a collection of short stories entitled *More Pricks Than Kicks* (1934). He soon relinquished his job and went out on a spree of restless travels until he again settled in Paris in 1937. In 1938, he published his first novel *Murphy,* which was followed by *Mercier et Camier* (1946), *Comment C'est,* (1961, English, 1964), *Imaginacion Morte Imaginez* (1965, English, 1965) and *Ill Seen Ill Said* (1982) His plays include *Fin de partie, suivi de Acte sans paroles I* (1957, English, 1958), *Krapp's Last Tape* (1959). His best play, however, is *En attendant Godot* (1952, Waiting for Godot, 1954). He has been a member of the American Academy of Arts and Sciences since 1968.

Peace

INTERNATIONAL LABOUR
ORGANIZATION (ILO)
Geneva

International Labour Organization (ILO) is a specialized agency of the United Nations to facilitate the improvement of conditions of labour and living standards of the labourers throughout the world. It was created after World War I by the peace settlement of 1919 as an affiliated body of the League of the Nations.

After the establishment of the UNO following World War II, the ILO became the first of its specialized agencies affiliated to it in 1946. The functions of this organization include the development and promotion of standards for national labour legislation and practice to protect and improve conditions of work and living. After the decolonization of the world following the World War II, most of the nations of the world have become associated with it. Its headquarters are located in Geneva and is composed of the permanent secretariat and the professional staff. It was awarded the prize for its worldwide humanitarian activities.

Economic Sciences

For having developed and applied dynamic models for the analysis of economic processes.

Frisch, Ragnar, b.—March 3, 1895, Oslo. d.—January 31, 1973, Oslo. He was the son of a goldsmith. He started his career as an apprentice in the workshop of the famous Oslo firm, David Andersen, and at the end of his apprenticeship he completed his handicraftsman's probation work as a goldsmith. On the advice of his mother, he later joined the University of Oslo.

FRISCH, RAGNAR
Norway

He took his university degree in economics in 1919. Between 1921 and 1923, he studied economics and mathematics in France and England. In 1925, he was appointed assistant professor at the Oslo University from where he obtained his Ph.D. in 1926. He received the Rockefeller Foundation grant which he utilized on his studies in the US, France and Italy during 1927-28. In 1928, he became associate professor and in 1931 professor at the Oslo University. He later became director of the Economic Institute in the Oslo University.

He lectured at the universities of Yale, Minnesota and Sorbonne. He was a member of various national and international societies and organizations. He was the recipient of honorary doctorates from a number of universities. He was awarded the Joseph A. Schumpeter Prize of Harvard University in 1955 and the Antonio Feltrinell Prize, Rome, in 1961. He was the author of several books.

◇

For having developed and applied dynamic models for the analysis of economic processes.

Tinbergen, Jan, b.—April 12, 1903, The Hague. A noted Dutch economist who took a Ph.D. degree on "Minimum Problems in Physics and Economics" in 1929 from the London University. From 1929 to 1945 he was incharge of business

TINBERGEN, JAN
The Netherlands

cycle research centre at the Central Bureau of Statistics, The Netherlands. Simultaneously, he worked at the League of Nations Secretariat in Geneva (1936-38). From 1949 to 1955 he was Director of the Government Planning Bureau. From 1956 to 1973 he worked as professor at the Erasmus University, Rotterdam. He was also the Chairman of the United Nations Committee for Development Planning. He has written extensively on the theory and policy of development planning. His younger brother Nikolaas Tinbergen is a Nobel Laureate in Physiology or Medicine (1973).

Note: The 1969 prize was awarded jointly to Frisch and Tinbergen.

1970

PHYSICS

Alfven, Hannes / Néel Louis

CHEMISTRY

Leloir, Luis F.

PHYSIOLOGY OR MEDICINE

Axelrod, Julius
Katz, Sir Bernard / Von Euler, Ulf

LITERATURE

Solsjenitsyn, Alexander

PEACE

Borlaug, Norman

ECONOMIC SCIENCES

Samuelson, Paul

1970

Physics

For fundamental work and discoveries in magneto-hydrodynamics with fruitful applications in different parts of plasma physics.

Alfven, Hannes, b.—May 30, 1908, Norrkoeping, Sweden. He is an astrophysicist and winner, with Louis Neel of France, of the prize for his essential contributions in founding plasma physics which means the study of plasmas or gaseous aggregates of molecules, electrons and ions.

ALFVEN, HANNES
Sweden

In 1940, Alfven joined the staff of the Royal Institute of Technology, Stockholm. During the late 1930s and early 1940s he made remarkable contributions to space physics including the theorem of frozen-influx, according to which under certain conditions a plasma is bound to the magnetic lines of flux that pass through it. Although originated as an explanation of sunspots, Alfven later used the concept to explain the origin of cosmic rays.

In 1939, Alfven published his theory of magnetic storms and the aurora, which influenced the modern theory of the magnetosphere. He discovered the widely used guiding centre approximation, by which the complex spiral motion of a charged particle in a magnetic field can be easily calculated.

Magnetohydrodynamics, or the study of plasmas in magnetic fields, was largely pioneered by him and his work has been acknowledged as fundamental in respect of attempts to central nuclear fusion. After numerous disagreements with the Swedish government, Alfven obtained a chair in the University of California at San Diego. Later, he divided his teaching time between the Royal Institute in Oslo and the University of California. Much of his early work, which had been published in obscure journals, was included in his compendium *Cosmical Electrodynamics* (1950).

◇

For fundamental work and discoveries concerning antiferromagnetism and ferromagnetism which have led to important applications in solid state physics.

Néel, Louis, b.—November 22, 1904, Lyons, France. Co-recipient, with the Swedish astrophysicist Hannes Alfven, of the prize for his pioneering studies of the magnetic properties of solids. His discoveries are major contributions to solid state physics and have found numerous useful applications, particularly in the development of improved computer memory storage units.

Néel was professor at the French universities of Strasbourg and also in Grenoble. During the early 1930s he studied forms of magnetism on the molecular level that differ from the most common variety, ferromagnetism, in which the electrons line up in the same direction at low temperatures. He discovered that in some substances alternating groups of atoms align their electrons in opposite directions, thus neutralizing the whole magnetic effect. This magnetic property is called antiferromagnetism.

Néel proposed the name ferromagnetism to describe compounds that have oppositely aligned electrons but, because of unequal individual magnetic fields, have a net magnetic field. His studies of fine grain ferromagnetics provided an explanation for the unusual magnetic memory of lava, basalt, and brick deposit that has provided information on changes in the direction and strength of the earth's magnetic field during the past.

NÉEL, LOUIS
France

Neel became director of the *Institut Polytechnique*, Grenoble, and also of the *Centre d' Etudes Nucleaires*, Grenoble. Mainly because of his contributions, ferromagnetic materials can be manufactured to almost any specifications for technical applications, and a horde of new synthetic ferrite materials has revolutionized microwave electronics.

Note: The 1970 prize was awarded jointly to Neel and Alfven.

Chemistry

For his discovery of sugar nucleotides and their role in biosynthesis of carbohydrates.

Leloir, Luis F., b.—September 6, 1906, Paris. A chemist, he graduated in medicine from the University of Buenos Aires in 1932. Two years later he went to the USA to work on enzymology after receiving a merit scholarship on the basis of a thesis. He carried on his studies in Cambridge; Washington University at St. Louis and Columbia. In 1944, he won the Argentine National Science prize and in 1947 was appointed to head the Campomar Foundation's Institute of Biochemical Research, where he worked with his associates and was crowned with the glory of Nobel prize.

LELOIR, LUIS F.
Argentina

His work is mainly based on the biological disintegration of carbohydrates including combustion. His research discoveries fundamentally altered the prevailing concepts on carbohydrate metabolism. The process by which foodstuffs are transformed into glucose and later into glucorene is well known now as the "Leloir's Road". This road is present in all living beings specially in the liver and leads to the formation of glycogen, a substance vitally important for carbohydrate metabolism.

Physiology or Medicine

For their discoveries concerning the humoral transmitters in the nerve terminals and the mechanism for their storage, release and inactivation.

Axelrod, Julius, b.—May 30, 1912, New York City. He graduated from the City College of New York. He wished to study medicine but could not do due to financial reasons. He became a laboratory assistant in the Department of Bacteriology at the New York University Medical School. In 1946 he became a research associate at the Goldwater Memorial Hospital, New York. It was here with the inspiration from his chief Dr. Bernard B. Brodie he became a good research worker.

He worked in various subjects like the investigation on the metabolic fates of amphetamines, ephedrine, adrenergic blocking agents and narcotic drugs. In 1953, he discovered enzyme in the liver microsome which are involved in the metabolism of drugs. Along with Drs. Strominger and Kalckar he found out the enzymes which convert uridinediphosphate glucose to uridinediphosphate glucuronic acid. He obtained his Ph.D. in 1955 from the George Washington University. In 1957 he engaged himself in researches on catecholamines. He found several enzymes and described the biosynthesis of melatonin in the pineal body and established that the hitherto so-called functionless structure is a neurochemical transducer. For his brilliant researches he was awarded the prize along with the Swede, Ulf von Euler and the British scientist Sir Bernard Katz in 1970. ◆

AXELROD, JULIUS
USA

For their discoveries concerning the humoral transmitters in the nerve terminals and the mechanism for their storage, release and inactivation.

Katz, Sir Bernard, b.—March 26, 1911, Leipzig. A British physiologist of German extraction who investigated into the functioning of nerves and muscles, specially at the site of transmission of a nerve impulse from nerve fibre to a muscle fibre.

Katz received his medical degree and the Garten Prize from the University of Leipzig in 1934. He emigrated to London and began studies at the University of London, receiving a Ph.D. in 1938 and a doctorate in science in 1943. He was a Beit Memorial Research fellow from 1938 to 1942. He became the assistant director of biophysics research at University College, London, in 1946 and head of the biophysics department and fellow of the Royal Society of London in 1952. Katz wrote *Electric Excitation of Nerve* (1939), *Nerve, Muscle and Synapse* (1966) and *The Release of Neural Transmitter Substances* (1969), as well as many articles in various scientific journals. ◆

KATZ, Sir BERNARD
Germany/Great Britain

For their discoveries concerning the humoral transmitters in the nerve terminals and the mechanism for their storage, release and inactivation.

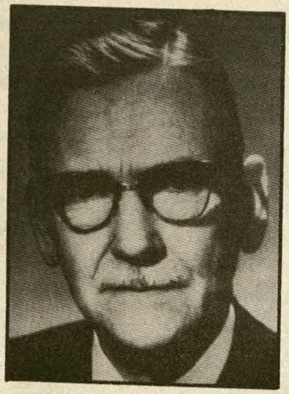
Von Euler, Ulf, b.—February 7, 1905, Stockholm, d.—March 12, 1983, Stockholm. He is the second son of Hans von Euler-Chelpin, Nobel Laureate for Chemistry in 1929. His father was born in Augsburg, Germany, the only son of Marshall Rigas von Euler-Chelpin. His mother was daughter of Per Teodor Cleve, who was professor of chemistry in Uppsala and the discoverer of the elements *thulium* and *holmium*. The mother received her Ph.D. in botany and later devoted most of her scientific activities to diatomes and to geology and obtained the title of professor in 1955.

After school years in Stockholm and in Karlstad he entered the Karolinska Institute as a medical student in 1922. The scientific atmosphere at home and the regular opportunities to meet great scientist like Svante Arrhenius (Nobel Laureate) who was his godfather, no doubt, had a great part in his growing interest in research. This was facilitated but never enforced upon him by his parents.

After a period of study with Robin Fahraeus (a pioneer in blood sedimentation and rheology) he began some research work on his own and was much encouraged by a prize given for a study on vasoconstrictor properties of pyrexial blood.

From 1926 he worked as assistant in G. Liljestrand's Department of Pharmacology and produced his thesis in 1930, followed by assistant professorship in Pharmacology in the same year.

Aided by the continuous support of Liljestrand he had the good fortune of obtaining a Rockefeller Fellowship for studies abroad (1930-31) with H.H. Dale (Nobel Laureate) in London, I.de Burgh Daly in Birmingham, C. Heymans (Nobel Laureate) in Ghent and G. Embden in Frankfurt. This period of diversified studies in physiology and pharmacology provided an invaluable basis for further research. Having had the good luck of discovering an active biological factor in intestinal extracts ("Substance P"), further developed with J.H. Gaddum in Dale's Laboratory, his interest soon after his return home turned in this direction and led subsequently to the findings of prostaglandin and vesiglandin (1935), piperidine (1942) and noradrenaline (1946).



VON EULER, ULF
Sweden

After the identification of noradrenaline as the adrenergic neurotransmitter in 1946 most of his research work has been devoted to this subject. Its distribution in nerves and organs, its excretion during various physiological and pathological conditions and its quantitation have been studied by him. The finding that the transmitter was stored in subcellular particles gave a new direction to the research, and problems concerning uptake, storage and release from nerve granules as well as the neurotransmission process have been the main research subject since 1958.

During 1953-60 he was a member of the Nobel Committee for Physiology or Medicine and served as the Secretary of the Committee in 1961-65. In 1965 he was appointed Chairman of the Board of the Nobel Foundation. He was vice president of the International Union of Physiological Sciences. He received numerous prizes, medals and honorary degrees.

Note: The 1970 prize was awarded jointly to Axelrod, Katz and Euler.

Literature

For the ethical force with which he has pursued the indispensable traditions of Russian literature.

Solsjenitsyn, Alexander, b.—December 11, 1918, Kislovodsk, Russia. A Russian novelist who achieved international fame in the early sixties with the publication of his book *Odm den iz shisni Ivana Denisovicha* (1962, One Day in the Life of Ivan Denisovich, 1963). It describes the tragic life of an inmate in a Russian labour camp during the rule of Stalin.

Solsjenitsyn was a posthumous child born in a family of Cossack intellectuals and was brought up by his mother, who was a teacher. He attended the university of Rostova-na-Donu and graduated in mathematics, but later took up a correspondence course in literature at the Moscow State University. He fought in World War II as a captain of the artillery. He was arrested for writing a letter criticizing Stalin and was imprisoned for eight years and later incarcerated in a detention camp for three more years. In 1956, he was allowed to settle in Ryzan, in Central Russia, where he became a teacher of mathematics and commenced writings.

The novel *One Day in the Life of Ivan Denisovich* was published in the Soviet Journal, *Novy Mir*, and the popularity was immediate. It produced a political stir both inside Russia and abroad and inspired a number of other Russian writers in exile to write accounts of severe life under Stalin. The post-Stalin liberalization of Russia was very short-lived for him. With the publication of a collection of short stories in 1963, he again evoked official disfavour, after which it became very difficult for him to publish his works. Several of his manuscripts were confiscated. In desperation he addressed an open letter to the Fourth National Congress of Soviet Writers reprimanding them for their betrayal of the cause of writers in Russia. Several of his works were printed thereafter in Russia as "Samizdat", meaning self-published and therefore illegal. Those were smuggled out of Russia and published abroad; these included *The Cancer Ward* (1968) and *The First Circle* (1968).

SOLSJENITSYN, ALEXANDER
USSR

He could not go to Stockholm to receive the prize because of official restriction. He published his book *August 1914* outside the Soviet Union in 1971. In August 1973, he criticized the Soviet government for curbing individual freedom. In 1973, the first part of *Gulag Archipelago, 1918-1956* was published in Paris; in this book he documented the inhuman oppression in Soviet labour camps. He was immediately attacked by the Russian press and was again arrested for treason. He was exiled from the Soviet Union in 1974 and came to Switzerland. He was made a member of the American Academy of Arts and Sciences in 1969 and a recipient of the Prix du Meilleur Livie Etranger in 1969. He now lives in the USA.

Peace

Borlaug, Norman, b.—March 25, 1914, Cresco, Iowa. He graduated in forestry in 1937, qualified M.S. in plant pathology in 1940 and received his Ph.D. in 1941—all from the University of Minnesota. An outstanding agricultural scientist and agronomist, he is responsible for the agricultural upliftment of many poor countries of the world including India. He initiated the "Green revolution" of India.

BORLAUG, NORMAN
USA

He was awarded a honorary doctorate by the Punjab Agricultural University in 1969. For his services to the food problem of the world through scientific and diversified cultivation he was awarded the prize.

Borlaug holds numerous honorary doctorates from both USA and abroad and more than 30 service awards by various governments and organizations, including US Medal of Freedom, 1977.

Economic Sciences

For the scientific work through which he has developed static and dynamic economic theory and actively contributed to raising the level of analysis in economic science.

Samuelson, Paul, b.—May 15, 1915, Gary, Indiana. He obtained his B.A. degree from the Chicago University in 1935 and M.A. degree from the Harvard University in 1936. In 1941, he took his Ph.D. degree from the same university. He was an assistant professor of economics at the Massachusetts Institute of Technology in 1940, an associate professor in 1947 and professor in

SAMUELSON, PAUL
USA

1966. He has been associated with a number of national and international economic associations and academies.

He has been a member, consultant and research adviser to several private and government institutes, boards and organizations. He has delivered many lectures at various universities and institutes of Europe and America. He is the recipient of about 20 honorary doctorates from American and foreign universities, and a number of awards and prizes. He is a contributing editor and columnist on economic topics for the *Newsweek*. He has published several books.

One of the greatest economic theorists of all times, Samuelson was the first American to receive the Nobel Prize in Economic Sciences.

1971

PHYSICS
Dennis, Gabor
CHEMISTRY
Herzberg, Gerhard
PHYSIOLOGY OR MEDICINE
Sutherland, Earl W. Jr.
LITERATURE
Neruda, Pablo
PEACE
Brandt, Willy
ECONOMIC SCIENCES
Kuznets, Simon

1971

Physics

For his invention and development of the holographic method.

Gabor, Dennis, b.—June 5, 1900, Budapest, d.—February 8, 1979, London. An electrical engineer and winner of the prize for his invention of holography, a system of three-dimensional photography without lenses which has numerous applications in medicine, topographic map-making, communications, and computer technology.

GABOR, DENNIS
Hungary/Great Britain

A research engineer for the firm of Siemens and Halske in Berlin from 1927, Gabor fled Nazi Germany in 1933 and worked with the Thomson-Houston Company in Rugby, Warwickshire. In 1947, he conceived the idea of holography and by using conventional filtered light sources he developed the basic technique. Because conventional light sources generally provided very little light that was too diffuse, holography did not become commercially feasible until the invention of the laser in 1960 by the US physicist Charles H. Townes which amplifies the intensity of light waves. In 1949, Gabor joined the faculty of the Imperial College of Science and Technology, London, where he became professor of applied electron physics. His other work includes research on high-speed oscilloscopes, communication theory, physical optics, and television.

Chemistry

For his contributions to the knowledge of electronic structure and geometry of molecules, particularly free radicals.

Herzberg, Gerhard, b.—December 25, 1904, Hamburg, Germany. A naturalized Canadian physicist and winner of the prize for his work in determining the electronic structure and geometry of molecules, especially free radicals. Herzberg became *Privatdozent* at the *Technische Universitaet* at Darmstadt, in Germany, in 1930. He fled from Nazi Germany in 1935 and obtained a position in the University of Saskatchewan, Canada. From 1945 to 1948 he worked at the Yerkes Observatory, Williams Bay, Wisconsin,

HERZBERG, GERHARD
Germany/Canada

and then returned to Canada, where he joined the National Research Council in Ottawa. He found out that depending on the conditions, atoms and molecules absorb or emit electromagnetic radiation of discrete wavelengths. This spectrum of radiation is directly dependent on the electronic and geometric structure of the atom or moleucle. Herzberg's spectroscopic studies not only provided experimental results of prime importance to physical chemistry and quantum mechanics but also helped to stimulate resurgence of investigations into the chemical reactions of various gases. He devoted much of his research to diatomic molecules, in particular the most common one, as hydrogen, oxygen, nitrogen, and carbon monoxide. He discovered the spectra of certain free radicals that are intermediate stages in numerous chemical reactions. He was the first to identify the spectra of certain radicals in interstellar gas. He also contributed much spectrographic information on the atmospheres of the outer planets and the stars. One of his important works is the *Molecular Spectra and Molecular Structure* (in three volumes, 1939-66).

Physiology or Medicine

For his discoveries concerning the mechanism of the action of hormones.

Sutherland, Earl W. Jr., b.—November 19, 1915, Burlingame, Kansas, d.—March 9, 1974, Miami, Florida. A pharmacologist and physiologist who was awarded the prize for isolation of cyclic adenosine monophosphate (cyclic AMP) and demonstration of its involvement in numerous metabolic processes which occur in animals.

SUTHERLAND, EARL W. Jr.
USA

Sutherland graduated from Washburn College in Topeka, Kansas, in 1937 and received the M.D. degree from Washington University Medical School, St. Louis, in 1942. After serving in the US Army during World War II, he joined the faculty of the Washington University. In 1953, he became director of the department of medicine at Western Reserve (now Case Western Reserve) University in Cleveland, Ohio, where he discovered cyclic AMP in 1952. In 1963, he became professor of physiology at Vanderbilt University at Nashville, Tennesse, and from 1973 till his death he was a member of the faculty of the University of Miami Medical School.

Literature

For a poetry that with the action of an elemental force brings alive a continent's destiny and dreams.

Neruda, Pablo, b.—July 12, 1904, Parral, Chile, d.—September 23, 1973, Santiago, Chile. A poet and a diplomat and one of the most prolific and original poets in Spanish. He was the son of a railway worker, and started writing poetry at a very early age. He adopted a pseudonym when he began to publish his works so as not to offend his father. Later in 1946, the pseudonym became his real name.

His first book *Crespuscülario* (1923) was published at his own expense.

In 1927, he was nominated as the honorary Chilean consul in Rangoon, later in Colombo and Jakarta. He was transferred to Buenos Aires where he met the noted poet Federico Garcia Lorca. His later works include *Canto general* (1950), *Las uvas y el Viento* (The Grapes and the Wind, 1954), *Terear libro de las odas* (The Third Book of Odes, 1957), *Viajes* (Journeys, 1958), *Cien Sonetos de Amor* (One Hundred Love Sonnets, 1959), *Memorial de Isla Negra* (Notes from Isla Negra, 1964), and *Fulgor y Murte de Joaquin Murieta* (1967).

He was awarded an honorary D.Litt. degree by Oxford University in 1965. He was an honorary

NERUDA, PABLO
Chile

member of the Lenin Peace Prize Committee and the Chile and Harvard Universities. He was also a member of the American Academy of Arts and Letters. He won the Lenin Peace Prize in 1953 and the International Peace Prize in 1950.

Peace

Brandt, Willy, b.—December 18, 1913, Luebeck, West Germany. A leader of the German Social Democratic Party and Chancellor of the Federal Republic of Germany from 1969 to 1974. Believing in a United Europe, he sought to enlarge the European Economic Community (EEC), especially by admitting the United Kingdom to its membership, and to improve relations with East Germany, other Communist nations in eastern Europe, and the Soviet Union.

For his work in East-West *(Ost Politik*) relations he was awarded the prize. From the rise of the Nazi Party to power in 1933 until the end of World War II in 1945, Brandt worked as a journalist in Norway and Sweden. He was elected mayor of West Berlin in 1957, and showed great moral courage during the Berlin crisis of 1961. In 1966 he was appointed the Foreign Minister of the Federal Republic of Germany. On October 21, 1969, he was elected as the Federal Chancellor and was retained in office when his party won the election in 1972. He resigned his office in May 1974, when a person in his close retinue was detected to be a spy of the Russians.

BRANDT, WILLY
Federal Republic of Germany

Economic Sciences

For his empirically founded interpretation of economic growth which had led to new and deepened insight into the economic and social structure and process of development.

Kuznets, Simon, b.—April 30, 1901, Kharkov, Ukraine. A Russian born economist who attended gymnasium in his native country and joined his father in New York City in 1922. He did his B.A. and M.A. in economics from the Columbia University in 1923 and 1924 respectively. In 1926 he took his Ph.D. from the same university.

He joined as assistant professor of economics at the University of Pennsylvania in 1930 and worked as professor of economics and statistics at the same university from 1935 to 1954. In 1954,

KUZNETS, SIMON
Russia/USA

he joined as professor of economics at the Johns Hopkins University and from there he shifted to Harvard University in 1960 where he became professor emeritus in 1971. He worked on the National Bureau for Economic Research from 1926 to 1960. He was associated with the National Income Committee of India, was economic advisor to People's Republic of China, and was on the editorial advisory board of the *International Encyclopedia of Social Sciences.*

Kuznets consistently aimed at giving quantitative precision of economic entities and also made important contributions to the development of national income statistics, especially the measurement of Gross National Product. He has published several books.

1972

PHYSICS

Bardeen, John / Cooper, Leon N.
Schrieffer, John Robert

CHEMISTRY

Anfinsen, Christian B. / Moore, Stanford
Stein, William H.

PHYSIOLOGY OR MEDICINE

Edelman, Gerald M. / Porter, Rodney R.

LITERATURE

Böll, Heinrich

ECONOMIC SCIENCES

Arrow, Kenneth J. / Hicks, Sir John R.

1972

Physics

For their jointly developed theory of superconductivity, usually called the BCS-theory.

BARDEEN, JOHN
USA

Bardeen, John. Twice recipient of the Nobel Prize in Physics (1956). ◇

For their jointly developed theory of superconductivity, usually called the BCS-theory.

Cooper, Leon N., b.—February 28, 1930, New York City. An American physicist. He was educated at Columbia where he obtained his Ph.D. in 1954. After brief spells at the Institute for Advanced Study, Princeton, the University of Illinois, and Ohio University, he moved in 1958 to Brown University, Providence, and was later (1962) appointed to a professorship of physics. Cooper's early work was in nuclear physics. In 1955 he began work with John Bardeen and John Robert Schrieffer on the theory of superconductivity. In 1956 he showed theoretically that at low temperatures electrons in a conductor could act in bound pairs (now called Cooper pairs). Bardeen, Cooper, and Schrieffer showed that such pairs act together with the result that there is no electrical resistance to flow of electrons through the solid. The resulting BCS-theory stimulated further theoretical and experimental work on superconductivity.

COOPER, LEON N.
USA

Cooper has also worked on the superfluid state at low temperatures and in a different field, on the theory of the central nervous system. ◇

For their jointly developed theory of superconductivity, usually called the BCS-theory.

Schrieffer, John Robert, b.—May 31, 1931, Oak Park, Illinois. An American physicist. He passed his B.S. from the Massachusetts Institute of Technology in 1953 and his M.S. from the Illinois University in 1954. He received his Sc.D. also from the Illinois University in 1974. As a post doctoral fellow in physics he worked in the Niels Bohr Institute at Copenhagen in 1957-58. He became an assistant professor at the University of

Chicago during 1957-59, and later went to the University of Illinois in the same capacity. He became associate professor there during 1960-62. He worked on superconductivity.

SCHRIEFFER, J. ROBERT
USA

His book *Theory of Superconductivity* (1964) is a very valuable text.

Schrieffer has been Professor of Physics since 1980 and Chancellor's Professor and Director of Institute for Theoretical Physics, University of California.

Note: The 1972 prize was awarded jointly to Bardeen, Cooper and Schrieffer.

Chemistry

For his work on ribonuclease, especially concerning the connection between the amino acid sequence and the biologically active conformation.

ANFINSEN, CHRISTIAN B.
USA

Anfinsen, Christian B., b.—March 26, 1916, Monaseen, Pennsylvania. An American biochemist who was a joint recipient of the prize along with Stanford Moore and William H. Stein for his research on the relationships between molecular structure and biological function of proteins. Anfinsen received his Ph.D. from Harvard University in 1943 and was in research and teaching posts at the Universities of Pennsylvania, Harvard, and the Nobel Institute in Stockholm. He joined the staff of the US National Institute of Health in 1950. His research has explained the facts on the adaption of the structure of enzymes and other proteins to their physiological activities. He wrote *The Molecular Basis of Evolution* in 1959.

◆

For their contribution to the understanding of the connection between chemical structure and catalytic activity of the active centre of the ribonuclease molecule.

MOORE, STANFORD
USA

Moore, Stanford, b.—1913, Chicago, d.—August 23, 1982. A chemist who shared the prize for establishing the molecular structures of proteins. He received his Ph.D. in 1938 from the Wisconsin University and joined the staff of the Rockefeller Institute of Medical Research in New York (1939). He became a professor there in 1952. He is widely known for his application of the technique to chromatography in the analysis of aminoacids and peptides. He determined the structure of the enzyme ribonuclease.

◆

For their contribution to the understanding of the connection between chemical structure and catalytic activity of the active centre of the ribonuclease molecule.

Stein, William H., b.—June 25, 1911, New York City. An American biochemist who was co-winner of the prize with C.B. Anfinsen and Stanford Moore for studies of the molecular structure of proteins.

STEIN, WILLIAM H.
USA

Stein received his Ph.D. degree from Columbia College of Physicians and Surgeons, New York, in 1938. In the same year he joined the staff of the Rockefeller Institute for Medical Research in New York. His research included the development of methods for the analysis of aminoacids and peptides obtained from proteins, and the application of those procedures to the determination of the structure of the enzyme ribonuclease.

Note: The 1972 prize was divided, one-half being awarded to Anfinsen and other half jointly to Moore and Stein.

Physiology or Medicine

For their discoveries concerning the chemical structure of antibodies.

Edelman, Gerald M., b.—July 1, 1929, New York. Edelman received medical degree from the University of Pennsylvania (1954) and his Ph.D. degree from Rockefeller Institute for Medical Research (1960). He served as a medical housestaff in Massachusetts General Hospital during 1954-55. He joined Rockefeller Institute as an assistant physician, becoming an assistant professor during 1960-63. He has been a professor of biochemistry there since 1966.

EDELMAN, GERALD M.
USA

Recipient of Spencer Morris award (University of Pennsylvania) and Eli Lilly award (American Chemical Society), Edelman is known for his other researches on protein chemistry, biophysics, fluorescence spectroscopy, primary and three-dimensional structure of protein.

In 1950, Edelman married Maxine M. Morrison and they have two sons.

◆

For their discoveries concerning the chemical structure of antibodies.

Porter, Rodney R., b.—October 8, 1917 Liverpool, d.—September 8, 1985. A British biochemist who was educated at a grammar school in Ashto-in-Makerfield, near Liverpool, and at Liverpool and Cambridge Universities. He studied for his Ph.D. degree under Dr. F. Sanger (Nobel Laureate—twice recipient).

In 1948, Porter started to investigate the structure of antibodies, but on moving to Mill Hill he worked on methods of protein fractionation collaborating with Dr. A.J.P. Martin. His specific interest was in chromatographic methods of fractionation. He returned to the study of the chemical structure of antibodies leading to the finding of the three fragments produced by splitting with papain in 1958-59. Continuing the work at St.

Mary's Hospital Medical School, he put forward the peptide chain structure of antibodies in 1962. He moved to Oxford University in 1967 to succeed Professor Sir Hans Krebs as head of the Department of Biochemistry. Since 1970, Porter has also been a member of Medical Research Council, and a Director of the M.R.C. Immunochemistry Unit at Oxford University which is involved in studies of structural basis of both the specific affinity and the general properties of immunoglobulins and also of the nature of cells concerned with immune response.

PORTER, RODNEY R.
Great Britain

Note: The 1972 prize was awarded jointly to Edelman and Porter.

Literature

For his writing which through its combination of a broad perspective on his time and a sensitive skill in characterization has contributed to a renewal of German literature.

Böll, Heinrich, b.—December 21, 1917, Cologne. A novelist who wrote on German miseries during and after World War II. He was the son of a cabinet-maker and worked for a bookseller after graduating from high school in 1937. He was called to labour service in 1938 and served six years as a soldier in the German army. After the war he settled in Cologne.

In his earlier novels *Der zug war puenktlich* (1949, The Train was on Time, 1956) and *Wo waerst du Adam* (Where had you been Adam, 1955), soldiers' unnatural emotions before death are detailed. The uneasiness of reality is explored in *Das Brot der fruehen Jahre* (1956, The Bread of Our Early Years, 1957) and in *Billard um halb zehn* (1959, Billards at Half-past Nine, 1961). In *Ansichten eines Clowns* (1963, The Clown, 1965), the performer degenerates due to alcoholism and from a well-paid circus entertainer becomes a beggar-musician.

BÖLL, HEINRICH
Federal Republic of Germany

His other writings include *Und Sagte Kein einziges wort* (1953, Acquainted with the Night, 1954), *Ende Einer Dienstfahrt* (1966, End of a Mission, 1968) and *In Gruppenbild mit Dame* (1971, Group Portrait with a Lady, 1973).

Economic Sciences

For their pioneering contributions to general economic equilibrium theory and welfare theory.

Arrow, Kenneth J., b.—August 23, 1921, New York. He obtained his B.Sc. in Social Sciences from the City College, New York in 1940, M.A. in 1941 and Ph.D. in 1951 from Columbia University. He was a research associate at the Cowles Commission for Research in Economics from 1947 to 1949. He worked as assistant professor, associate professor and professor of economics at Stanford University during 1949-68. He accepted the chair of university professor of economics at Harvard in 1968 and remained there till 1979. He has been at Stanford University as Professor of

Economics since 1979. He was Fellow, Churchill College, Cambridge, in 1963-64, 1970 and 1973. He has been a member and fellow of many associations and academies.

ARROW, KENNETH J.
USA

In addition to his contributions to general economic equilibrium theory and welfare theory, Arrow was also cited by the Swedish Academy of Sciences for his contributions to growth theory and decision theory. He has published several books.

◆

For their pioneering contributions to general economic equilibrium theory and welfare theory.

Hicks, Sir John R., b.—April 8, 1904, Warwick, England. He received his education at Clifton College during 1917-22 and at Balliol College, Oxford, during 1922-26. His first teaching assignment was at the London School of Economics where he taught from 1926 until 1935 when he moved to Cambridge. In 1938, he joined as professor of political economics at the University of Manchester, and remained there for six years. In 1946, he was made fellow of Nuffield College, Oxford. In 1952, he was appointed Drummond professor of political economy at Oxford, a post he held until 1965. Finally, he was a research fellow at All Souls College, Oxford, during 1965-71.

HICKS, Sir JOHN R.
Great Britain

Professor Hicks has been a fellow of British Academy, Royal Swedish Academy, and of the American Academy. He is the recipient of honorary doctorates, from a number of national and foreign universities. He was knighted in 1964. He was the first British economist to receive the prize along with Kenneth J. Arrow for "pioneering contribution to general economic equilibrium theory and welfare theory."

He ranks as a major economic theoretician whose contributions include such diverse areas as microeconomics, trade cycles, welfare economics, public finance, international trade, macroeconomics, growth economics and monetary theory.

He is the author of several books.

Note: The 1972 prize was awarded jointly to Arrow and Hicks.

1973

PHYSICS

Esaki, Leo / Giaever, Ivar
Josephson, Brian D.

CHEMISTRY

Fischer, Ernst Otto
Wilkinson, Sir Geoffrey

PHYSIOLOGY OR MEDICINE

Lorenz, Konrad / Tinbergen, Nikolaas
Von Frisch, Karl

LITERATURE

White, Patrick

PEACE

Kissinger, Henry A. / Tho, Le Duc

ECONOMIC SCIENCES

Leontief, Wassily

1973

Physics

For their experimental discoveries regarding tunneling phenomena in semiconductors and superconductors, respectively.

Esaki, Leo, b.—March 12, 1925, Osaka, Japan. A Japanese physicist, Esaki graduated in physics from the University of Tokyo in 1947, where he later gained his doctorate in 1959. His doctoral work was on the physics of semi-conductors, and in 1958 he reported an effect known as "tunneling", which he had observed in narrow p-n junctions of germanium that were heavily doped with impurities. The phenomenon of tunneling is a quantum-mechanical effect in which an electron can penetrate a potential barrier through a narrow region of solid, where classical theory predicts it could not pass.

ESAKI, LEO
Japan

Esaki was quick to see the possibility of applying the tunnel effect, and in 1960 reported the construction of a device with diodelike properties, "the tunnel (or Esaki) diode". With negative bias potential, the diode acts as a short circuit, while under certain conditions of forward bias it can have effectively negative resistance (the current decreasing with increasing voltage). Important characteristics of the tunnel diode are its very fast speed of operation, small physical size, and low power consumption. It has found application in many fields of electronics, principally in computers, microwave devices, and where low electronic noise is required. Esaki shared the prize with Brian Josephson and Ivar Giaever.

Esaki now works for the computer firm International Business Machines at the Thomas J. Watson Research Center, Yorktown Heights, New York, USA.

◆

For their experimental discoveries regarding tunneling phenomena in semiconductors and superconductors, respectively.

Giaever, Ivar, b.—April 5, 1929, Bergen, Norway. An American physicist, Giaever studied electrical engineering at the Norwegian Institute

GIAEVER, IVAR
Norway/USA

of Technology. In 1954 he emigrated to Canada to take up the post of mechanical engineer with the Canadian General Electric Company. He was later transferred to the Canadian General Electric's Research and Development Centre in Schenectady, New York, in 1956. He gained his doctorate in 1964 from the New York Rensselaer Polytechnical Institute. At General Electric, Giaever worked on tunneling effects in superconductors, a phenomenon explored by Leo Esaki. In 1960 he performed experiments with metals separated by a thin insulating film through which electrons tunneled, and found that if one of the metals was in the superconducting state, the current voltage characteristics of such junctions were highly nonlinear and revealed much about the superconducting state. This laid the foundation for Brian Josephson's important discovery of the Josephson effect.

Giaever, Josephson and Esaki shared the prize for their various contributions to knowledge of the phenomenon of tunneling and superconductivity. Their work has had important applications in microelectronics and in the precise measurement of electromotive force. Subsequently, Giaever has also published work in the field of visual observations of the antibody antigen reaction.

◆

For his theoretical predictions of the properties of a supercurrent through a tunnel barrier, in particular those phenomena which are generally known as the Josephson effects.

Josephson, Brian D., b.—January 4, 1940, Cardiff, Wales. He earned BA, MA & Ph.D. from Cambridge. He was only 22 years old and a graduate student in Cambridge when he made the discoveries that gained him a share of the prize.

JOSEPHSON, BRIAN D.
Great Britain

He is an Assistant Director of Research in Cambridge and a Reader in Physics. He spent a year at the University of Illinois as an Assistant Research Professor. He made theoretical prediction of the properties of supercurrent through a tunnel barrier a phenomenon now well known as "Josephson effect"

Note: The 1973 prize was divided one-half being awarded jointly to Esaki and Giaever and other half to Josephson.

Chemistry

For their pioneering work, performed independently, on the chemistry of the organometallic, so called sandwich compounds.

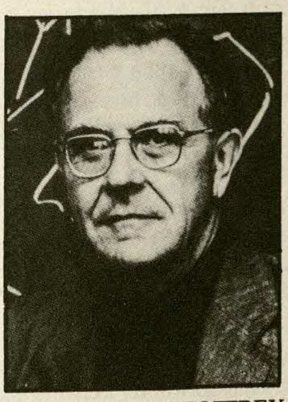
Fischer, Ernst Otto, b.—November 10, 1918, Munich, now in West Germany. A German inorganic chemist, Fischer the son of a physics professor was educated at the Munich Institute of Technology, where he obtained his Ph.D. in 1952. He taught at the University of Munich serving as professor of inorganic chemistry from 1957 to 1964 when he became the director of the Institute for

FISCHER, ERNST OTTO
Federal Republic of Germany

Inorganic Chemistry at the Institute of Technology.

Fischer is noted for his work on inorganic complexes. In 1951 two chemists T. Kealy and P. Pauson, discovered a compound $C_5H_5FeC_5H_5$, which they proposed had an iron atom joined to a carbon atom on each ring. Fischer, on reflection, considered such a structure inadequate for he failed to see how it could provide sufficient stability with its carbon-iron-carbon bonds. The British chemist Geoffrey Wilkinson suggested a more novel structure in which the iron atom was sandwiched between two parallel rings and thus formed bonds with the electrons in the rings rather than with individual carbon atoms. Compounds of this type are called "sandwich compounds". By careful X-ray analysis Fischer confirmed the proposed structure of ferrocene, as the compound was called and for this work shared the prize with Wilkinson. Fischer went on to do further work on transition-metal complexes with organic compounds and is one of the leading workers in the field of organometallic chemistry. ◆

For their pioneering work, performed independently, on the chemistry of the organometallic, so called sandwich compounds.



WILKINSON, Sir GEOFFREY
Great Britain

Wilkinson, Sir Geoffrey, b.—July 14, 1921, Todmorden, England. A British inorganic chemist, he was educated at Imperial College, London, where after spending the war years working in North America on the development of the atomic bomb, he finally obtained Ph.D. in 1946. He later worked at the Massachusetts Institute of Technology and at Harvard, before being elected to the chair of inorganic chemistry at Imperial College. Wilkinson is noted for his studies of inorganic complexes. A theme of Wilkinson's work in the 1960s was the study and use of complexes containing a metal hydrogen bond. Thus, complexes of rhodium with triphenyl phosphine ($(C_6H_5)_3P$) can react with molecular hydrogen. The compound RhCl $(P(C_6H_5)_3)$, known as Wilkinson's catalyst, was the first such complex to be used as a homogeneous catalyst for adding hydrogen to the double bonds of alkenes. This type of compound can also be used as a catalyst for the reaction of hydrogen and carbon monoxide with alkenes (hydroformylation). It is the basis of industrial low-pressure techniques for making aldehydes.

Note: The 1973 prize was awarded jointly to Fischer and Wilkinson.

Physiology or Medicine

For their discoveries concerning organization and elicitation of individual and social behaviour patterns.

Lorenz, Konrad, b.—November 7, 1903, Vienna. He is the son of the famous Viennese orthopaedic surgeon Prof. Adolf Lorenz, who is still honoured as the father of operative orthopaedic surgery.

LORENZ, KONRAD
Austria

Konrad grew up in the small village named Altenburg in Austria. He studied zoology and medicine in Vienna and in the USA. He was appointed an assistant professor of Anatomy in the University of Vienna where he met Erich von Holst an *ethologist* (who are experts on animal behavioural studies). He was made a full professor of Anatomy at Koenigsberg University. He was called for services in the Army in 1942, and was captured by the Russians in 1944. After spending his term as a prisoner of war for four years he was freed.

Out of the concepts of Eric von Holst, Lorenz developed the modern science of ethology and brought it to the present high standards. He is presently busy in the study of human aggression. He is a prolific writer and his books include: *King Solomon's ring* (1952), *Man meets dog* (1954), and *On aggression* (1966). His research methods are described in *Ueber Tierisches und Menschliches Verhalten* (1965, *Studies in Animal and Human Behaviour*, in 2 volumes, 1970-71). He shared the Nobel Prize for Physiology/Medicine in 1973 along with the animal behaviourists Karl von Frisch and Nicolaas Tinbergen. ◆

For their discoveries concerning organization and elicitation of individual and social behaviour patterns.

Tinbergen, Nikolaas, b.—April 15, 1907, The Hague. A zoologist and an ethologist. After receiving a Ph.D. degree (1932) from Leiden University, Tinbergen taught there until 1949. He then joined the faculty of Oxford University where he subsequently organized a research department on animal behaviour. With Konrad Lorenż, Tinbergen is credited with revitalizing the science of ethology. Their emphasis was on field observations of animals under natural conditions. Tinbergen is especially well known for his long-term observations of sea gulls, which led to significant generalizations on courtship and mating behaviour. Among his important writings are *The Herring Gull's World* (1960), *Social Behaviour in Animals* (1953), and *Animal Behaviour* (1965). Perhaps his most influential work is *The Study of Instinct* (1951), which explores the work of the European ethological school up to that time and attempts at a synthesis with American ethology. He is the younger brother of Jan Tinbergen, the Nobel Laureate in Economic Sciences for 1969. ◆

TINBERGEN, NIKOLAAS
The Netherlands/Great Britain

For their discoveries concerning organization and elicitation of individual and social behaviour patterns.

Von Frisch, Karl, b.—November 20, 1886, Vienna, d.—1982. A zoologist whose studies of communication among bees added significantly to the knowledge of the chemical and visual sensors of insects as early as in 1901. He received his Ph.D. degree from the University of Munich in 1910. At the University of Rostock, Germany, he was appointed the director of the Zoological Institute in 1921 and later accepted a similar position at the University of Breslau. In 1925, he returned to the University of Munich where he established the Zoological Institute. This institute was destroyed during World War II when he joined the staff of the University of Graz in Austria, but again returned to Munich in 1950, remaining there until his retirement in 1958.

Frisch initiated a study which proved that fishes could distinguish differences of colour and brightness. He also proved that auditory acquity and sound distinguishing ability in fishes was superior to that of man.

He is best known for his studies on bees. In 1919, he demonstrated that bees can be trained to distinguish between various tastes and odours. He also found that their sense of taste was not highly developed. He found that bees communicate the distance and direction of food supply to other members of the colony by two types of rhythmic movements or dances; a circling dance indicates that food is within 75 metres of the hive, while a wagging dance indicates a greater distance.

VON FRISCH, KARL
Federal Republic of Germany

In 1949 Frisch established that bees use the Sun as a compass through their perception of polarized light. He also found that they are capable of using this method of orientation when the Sun is not visible, apparently remembering the patterns of polarization present in the sky at different times of the day and the location of known landmarks.

Note: The 1973 prize was awarded jointly to Lorenz, Tinbergen and Frisch.

Literature

For an epic and psychological narrative art which has introduced a new continent into literature.

White, Patrick, b.—May 28, 1912, London. An Australian author and very influential in a group of 20th century novelists. He went to Australia as a child but came back to England for school education. He had his university education in Cambridge.

After serving in World War II as an intelligence officer with R.A.F., he lived in Australia, England and the USA. He became known as a novelist with the publication of his novel *Happy Valley* in 1939. It is set in a typical New South Wales countryside. The material of his later novels is also typically Australian and he writes about the ethnicity and rootlessness of the people. The other novels to follow were *The Living and the Dead* (1941) and *The Aunt's Story* (1948). His country is reflected through *The Tree of Man* (1955), *Voss* (1957), *Riders in the Chariot* (1961), *The Solid Mandala* (1966) and many more.

WHITE, PATRICK
Australia

He wrote a few plays which include *The Season in Sarsaparilla* (1961), *Night on a Bald Mountain* (1962), *Big Toys* (1977), *Signal Tower* (1982) and *Netherwood* (1983). He won the W.H. Smith award in 1959 and was made a companion of the order of Australia in 1975, but he resigned from it in 1976.

Peace

Kissinger, Henry A., b.—May 27, 1923, Fuerth, Germany. A political scientist, adviser for national security affairs to four American presidents, and secretary of state. Kissinger came with his family to the USA in 1938 to escape Nazi persecution of Jews in Germany. He studied accounting at City College, New York, and served in the US Army during World War II and in 1945-46 in the US military government of Germany. He entered Harvard University, receiving his Ph.D. in 1954, and became a temporary instructor. By 1962, he was a full professor at Harvard, where he was also Director of University's Defence Studies Program. He served as a consultant on security matters to various US agencies during the administrations of presidents Eisenhower, Kennedy and Johnson.

Kissinger's book *Nuclear Weapons and Foreign Policy* (1957) established him as a leading authority on US strategic policy. That book and the subsequent publication *The Necessity for Choice* (1960), in which Kissinger limited his flexible response to include only conventional forces and in which he warned of "missile-gap" between the Soviet Union and the US greatly influenced President Kennedy.

KISSINGER, HENRY A.
Germany/USA

Though Kissinger had previously been critical of Nixon, he accepted his appointment as assistant to President Nixon for national security affairs. He also became executive secretary of the National Security Council. Kissinger soon emerged as a far more influential figure in the Nixon administration than the secretary of state. Not only was he the chief foreign policy adviser to the President, but he also assumed an active diplomatic role. He initiated the strategic arms limitation talks (SALT) in 1969, reached agreements in 1972 with the Soviet Union, established the US pro-Pakistan policy in the Indo-Pakistan war of 1971, and developed a rapproachement between the USA and the People's Republic of China. In addition, Kissinger played a major role in Nixon's Vietnamization policy or the disengagement of US troops from South Vietnam and their replacement by South Vietnamese forces. On January 23, 1973, he initialled the agreement of ending the war and restoring peace in Vietnam on behalf of the USA after months of negotiations in Paris. Late in 1973, he became Secretary of State. He shared the prize with the North Vietnamese negotiator, Le Duc Tho (who did not accept the award).

After the Arab-Israeli war of 1973, Kissinger was active, and largely successful, in promoting peace between the belligerents. His negotiations led to the signing of an accord between Egypt and Israel to separate their forces along the Suez Canal. He also promoted talks between Israel and Syria that led to agreement to disengage their forces from the Golan Heights. ◆

Tho, Le Duc, b.—October 14, 1911, Dich Le, Nam Ha Province, North Vietnam. He did not have much formal education other than some minor schooling in his native village. He came under the influence of the great leader of his country Ho Chi Minh at the tender age of only twenty years.

THO, LE DUC
Democratic Republic of Vietnam

He engaged himself as a wholetime fighter for the cause of liberation of Vietnam from French domination. He was put in gaol on countless occasions by the French rulers. When the question of American pull-out from the Vietnam war arose he was appointed the chief negotiator *vis-a-vis* Henry Kissinger, the American counterpart. After establishment of peace in Vietnam he and Kissinger were honoured with the Nobel Prize. Kissinger accepted the prize but the proud little Vietnamese, Le Duc Tho, rejected it outright.

Note: The 1973 prize was awarded jointly to Kissinger and Le Duc Tho.

Economic Sciences

For the development of the input-output method and for its application to important economic problems.

Leontief, Wassily, b.—August 5, 1906, Leningrad, Russia. He was a student of the Leningrad University during 1921-25. He received his Ph.D. from the Berlin University in 1928. In 1928-29, he visited Nanking as economic consultant to the Government of China. Leontief immigrated to the USA in 1931 and worked as a research associate with the National Bureau of Economic Research in New York. He joined Harvard University as an instructor in 1931, was appointed assistant professor in 1933, associate professor in 1939, and Henry Lee professor of economics in 1946, the last post he held until 1975 when he joined New York University.

He established the Harvard Economic Research Project on the structure of the American economy in 1948 and was its director up to 1975. It was this project which led him to complete his pioneering work on input-output analysis. He was a part-time consultant to the US Department of Labour from 1961 to 1965, and to the Department of Commerce in 1966.

LEONTIEF, WASSILY
USSR/USA

He has been a member of a number of national and foreign societies. He has given an empirically useful method to highlight the general interdependence in the production system of a society.

He is also the originator of the Leontief Paradox in the theory of international trade. He is the author of several books.

1974

PHYSICS

Hewish, Antony / Ryle, Sir Martin

CHEMISTRY

Flory, Paul John

PHYSIOLOGY OR MEDICINE

Claude, Albert / de Duve, Christian
Palade, George E.

LITERATURE

Johnson, Eyvind / Martinson, Harry

PEACE

Sato, Eisaku / MacBride, Sean

ECONOMIC SCIENCES

Myrdal, Gunnar / Von Hayek, Friedrich August

Physics

For their pioneering research in radio astrophysics: Ryle for his observations and inventions, in particular of the aperture synthesis technique, and Hewish for his decisive role in the discovery of pulsars.

Hewish, Antony, b.—May 11, 1924, Fowey, England. A British radio astronomer, he studied at Cambridge University from where he obtained his BA in 1948 and his Ph.D. in 1952 after wartime work with the Royal Aircraft Establishment, Farnborough. He lectured in physics at Cambridge, in 1969 he was made reader and in 1971 professor of radio astronomy. One of Hewish's research projects was the study of radio scintillation using the 4.5 acre telescope, which consisted of a regular array of 2048 dipoles operating at a wavelength of 3.7 metres. Radio scintillation is a phenomenon, similar to the twinkling of visible stars, arising from random deflections of radio waves by ionized gas. The three types of scintillations are caused by ionized gas in the interstellar medium, in the interplanetary medium, and in the Earth's atmosphere. All three types were discovered at Cambridge and Hewish was involved in their investigation. In 1967 a research student, Jocelyn Bell, noticed a rapidly fluctuating but unusually regular radio signal that turned out to have a periodicity of 1.337 301 13 seconds. She had discovered the first pulsar. To determine the nature of the signal Hewish's first job was to eliminate such man-made sources as satellites, radar echoes and the like. Measurements indicated that it must be well beyond the solar system. It seemed possible that it had been transmitted by an alien intelligence and the LGM (Little Green Man) hypothesis, as it became known, was seriously considered at Cambridge but with the rapid discovery of three more pulsars it was soon dropped. Hewish did however manage to establish some of the main properties of the pulsar from a careful analysis of its radio signal. Apart from its striking regularity it was extremely small, no more than a few thousand kilometres, and was situated in our Galaxy. By the end of February 1968 Hewish was ready to publish. His account received wide publicity in the popular press and stimulated much thought among astronomers as to the possible mechanism. The proposal made by Thomas Gold and others that pulsars were rapidly rotating neutron stars has since won acceptance. Jocelyn Bell's contribution was totally ignored by the Nobel Committee while considering Hewish for the prize. ◇

HEWISH, ANTONY
Great Britain

For their pioneering research in radio astrophysics: Ryle for his observations and inventions, in particular of the aperture synthesis technique, and Hewish for his decisive role in the discovery of pulsars.

Ryle, Sir Martin, b.—September 27, 1918, England, d.—1984. A radio astronomer who developed revolutionary radio telescope system and used them for accurate location of weak radio sources. With improved equipment, he has observed the most distant known galaxies of the universe and possibly the very edge of the observable universe. During World War II Ryle worked with the Telecommunications Research Establishment, Swanage, Dorset, on the design of radar equipment. After the War he received a fellowship at the Cavendish Laboratory, where he became an early investigator of extraterrestrial radio sources and developed advanced radio telescopes using the principles of radar. While serving as university lecturer in physics at Cambridge, he became director of the Mullard Radio Astronomy Observatory and, later, professor of radio astronomy. He was appointed Astronomer Royal in 1972. Ryle's early work in radio astronomy was on studies of radio waves from the sun, sunspots, and a few nearby stars. Under his leadership, the Cambridge radio astronomy group compiled catalogs of extraterrestrial radio sources. His researches led to the discovery of the first quasi-stellar radio source called the "quassar".

RYLE, Sir MARTIN
Great Britain

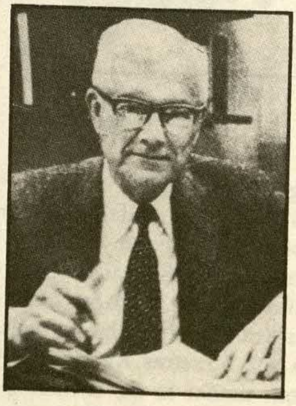
One of the major tools used to map such distant radio sources as quassars was a technique developed by Ryle called aperture synthesis. By using two radio telescopes and changing the distance between them, computer analysis of the combined radio wave reception provides tremendously increased sensitivity. In the mid-1960s Ryle's one-mile telescope went into operation of two telescopes on rails placed at the maximum distance of one mile (1.6 kilometres) they provide results comparable to a single telescope one mile in diametre. This telescope system was used to locate the "first pulsar", which was discovered in 1968 by Antony Hewish and Jocelyn Bell of the Cambridge Group.

Note: The 1974 prize was awarded jointly to Ryle and Hewish.

Chemistry

For his fundamental achievements, both theoretical and experimental, in the physical chemistry of the macromolecules.

Flory, Paul John, b.—June 19, 1910, Sterling, Illinois. An American polymer chemist, Flory was educated at Ohio State University, where he obtained his Ph.D. in 1934. His career has been divided between industry and university. He worked with Du Pont from 1934 until 1938 on synthetic polymers and then spent the next two years at the University of Cincinnati. After working for Standard Oil from 1940 until 1943, Flory served as Director of Fundamental Research for the Goodyear Tire Company in Akron, Ohio, until 1948. He was then appointed to the chair of chemistry at Cornell. He left Cornell in 1957 to become director of research of the Mellon Institute in Pittsburgh and finally in 1961, accepted the chair of chemistry at Stanford University, California.



FLORY, PAUL JOHN
USA

Flory began work on the properties of polymers in the 1930s. A particular problem at the time was that polymer molecules do not have a definite size and structure, a given polymeric material consists of a large number of macromolecules with different chain lengths. Flory approached this problem using statistical methods, obtaining expressions for the distribution of chain lengths. In further work he developed a theory of non-linear polymers, which involve cross linkages between molecular chains. He showed how such extended structures can form from a solution of linear polymers. A particular innovation was the concept of "Flory temperature"—a temperature for a given solution at which meaningful measurements can be made of the properties of the polymer.

In later work Flory considered the elasticity of rubbers and similar polymeric materials. He has published two authoritative books, *Principles of Polymer Chemistry* (1953) and *Statistical Mechanics of Chain Molecules* (1969).

Physiology or Medicine

For their discoveries concerning the structural and functional organization of the cell.

Claude, Albert, b.—1899, Longier, Belgium, d.—May, 1983. A Belgian cytologist who graduated in medicine from the University of Liegé in Belgium and was for 20 years attached to the Rockefeller Institute, New York. In 1950 he became a professor at the Free University of Brussels and director of the Bordet Institute. In 1955 he was the Francqui professor at the University of Leigé. Subsequently, he set up a cytology laboratory for the Catholic University of Louvain. He has obtained many Belgian and foreign awards for his work, which led to research about the way in which the components of cells could be isolated and into the biochemical study of their infrastructure. He was one of the pioneers of electron microscopy and has carried out important research into certain forms of cancer. ◇

CLAUDE, ALBERT
Belgium

For their discoveries concerning the structural and functional organization of the cell.

de Duve, Christian, b.—October 2, 1917, Thames-Ditton, England. A Belgian cytologist who was educated in medicine at the Catholic University of Louvain. In 1954 he became ordinary professor at Louvain University and in 1962 was appointed professor of biochemical cytology at the Rockefeller Institute, New York. His work in the field of biochemistry and cellular pathology has earned him many scientific awards like the Louis Empaign prize in 1943, the Pfizer Foundation prize in 1957, the Francqui prize in 1960 and the Heineken prize of the Royal Academy of Science of Amsterdam in 1973. During 1962-63 he held the Francqui professorship at the State University of Ghent, and during 1963-64 he held the same professorship at the University of Brussels. ◇

DE DUVE, CHRISTIAN
Belgium

For their discoveries concerning the structural and functional organization of the cell.

Palade, George E., b.—November 19, 1912, Jassy, Romania. A Romanian born American molecular biologist, he studied in the Bucharest Medical School and graduated in 1940. He immediately started researches in cancer.

PALADE, GEORGE E.
Romania/USA

In 1946 he went to USA on a Rockefeller Foundation Fellowship and joined the Rockefeller University in New York City. He stayed on in the USA after the term of his scholarship was over and started work along with Porter and identified *endoplasmic reticulum* and also the fact that it contained several fine tubes. They also found that mitochondria was suspended in the cytoplasmic ground substance. He also researched on blood capillaries and found out how essential life supporting materials were transported through the capillary walls.

Note: The 1974 prize was awarded jointly to Claude, Duve and Palade.

Literature

For a narrative art, far-seeing in lands and ages, in the service of freedom.

Johnson, Eyvind, b.—July 29, 1900, Svartbjoersbyn, near Boden, Sweden. He is a working class novelist and introduced new themes and points of view in Swedish literature and experimented with new forms and techniques.

His father was a poor stone-cutter and a victim of silicosis of lungs. Johnson did not have any formal education.

JOHNSON, EYVIND
Sweden

His early novels had the influence of Proust, Gide and Joyce and are mainly concerned with human frustration. His first book, *De fyra främlingarna* (The Four Strangers) which appeared in 1924, was followed by *Bobinack* (1932), and *Regn i gyringen* (1933, Rain at Daybreak). During the war and immediately before it, his novels took the form of intense protest against neutralism. *Straendernas svall* (1946, Return of Ithaca, 1952) is his best known work and has been widely translated.

◆

For writings that catch the dewdrop and reflect the cosmos.

Martinson, Harry, b.—May 6, 1904, Jaemshhoeg, Blekinge, Sweden. A novelist and a poet. He was

MARTINSON, HARRY
Sweden

the first self-taught and working class writer to be elected to the Swedish Academy (1949). He abandoned his home at the age of seven when his father died and roamed about like a vagabond. For a while he worked as a manual labourer and sailor.

His unusual experience of this period is recorded in two autobiographical-novels, *Nausslorna blomma* (1935, Flowering Nettle, 1936) and *Vagen ut* (1936, Way Out). His sensitive travel details are to be found in *Resor utan mael* (1932, Aimless Journeys) and *Kap Farvael* (1933, Cape Farewell, 1934). Among his most famous works are *Passed* (1945, Trade Wind) and *Vaegen till Klockrike* (1948, The Road, 1955). *Aniara* (A Review of Man in Time and Space, 1963) is a spaceship fantasy in verse which was converted later into a successful opera by the Swedish composer Karl Birger Bloemahl.

Note: The 1974 prize was awarded jointly to Johnson and Martinson.

Peace

Sato, Eisaku, b.—March 27, 1901, Tabuse, Japan, d.—June 3, 1975, Tokyo. The prime minister of Japan between 1964 and 1972. He presided over the post-war re-emergence of Japan as a major world power. He signed the nuclear non-proliferation treaty and received the prize along with the Irish pacifist, Sean MacBride.

SATO, EISAKU
Japan

He graduated from the Tokyo Imperial University in 1924 and joined the ministry of railways and gradually rose step by step to the post of vice-Minister of Transportation in 1948. In the same year he joined the Liberal Party and was elected to the Lower House of the Japanese Diet in 1949. He served as the minister of finance in the government led by Nobusuke Kishi. When Hyaro Ikeda became prime minister of Japan after Kishi, he became the minister of international trade in his cabinet. He resigned from the cabinet in 1972.

◇

MacBride, Sean, b.—January 26, 1904, Pietermaritzburg, South Africa. The Irish statesman, who was awarded the prize for his efforts in establishing human rights.

MACBRIDE, SEAN
Ireland

MacBride is the son of Maud Gonne, the Irish actress and patriot, who refused to marry the poet William Butler Yeats and instead married Maj. John MacBride, who was executed in 1916 for taking part in the Easter Rising of 1916 against the British.

Like his parents he became the chief of staff of the Irish Republican Army at the age of only 24. He worked as a journalist and then became a lawyer. Eventually accepting the fact of partition and the futility of warfare, he entered the *Dail Eireann* in 1947 as member of the *Clann na Poblachta* or Republican Party, which he had founded in 1936. He was minister for external affairs in 1948-51. In 1950, he was president of the Council of Foreign Ministers of the Council of Europe, and was vice-president of the Organization for European Economic Cooperation (EEC) in 1948-51. MacBride was active in a number of international organizations concerned with human rights such as the International Prisoners of Conscience Fund and Amnesty International. He served as the secretary general of the International Commission of Jurists. He became United Nations Commissioner for South West Africa in 1973.

Note: The 1974 prize was awarded jointly to Sato and MacBride.

Economic Sciences

For their pioneering work in the theory of money and economic fluctuations and for their penetrating analysis of the interdependence of economic, social and institutional phenomena.

Myrdal, Gunnar, b.—December 6, 1898, Gustafs Parish, Sweden, d.—May 17, 1987, Stockholm. He graduated from the Law School of Stockholm University in 1923 and began practising law while continuing his studies at the University. He received his doctoral degree in economics in 1927 and was appointed a Docent in political economy at Stockholm University. From 1925 to 1929 he studied for short periods in Germany and Britain, followed by his first trip to the United States in 1929-30 as a Rockefeller Fellow. Returning to Europe, he served as an associate professor in the Post-graduate Institute of International Studies, Geneva, Switzerland. In 1933, he was appointed to the Lars Hierta Chair of Political Economy and Public Finance at the University of Stockholm, as the successor of his professor Gustav Cassel.

From 1936 to 1938, he was a member of Swedish Parliament as a social democrat.

In 1938 the Carnegie Corporation of New York commissioned him to direct a study of the American Negro problem. The material which he collected and interpreted was published in 1944 as *An American Dilemma: The Negro Problem and Modern Democracy*.

After a period as Economic Adviser to the Swedish legation in the US, he was Minister of Commerce in the Swedish Government from 1945 to 1947. In 1947, he became Secretary General of the UN Economic Commission for Europe at Geneva, where he worked until 1957.

MYRDAL, GUNNAR
Sweden

In 1957 he directed a comprehensive study of economic trends and policies in South Asian countries which resulted in *Asian Drama: An Inquiry into the Poverty of Nations* (1968). In 1961 he was back in Sweden and was appointed professor of International Economic Studies at the University. He was the first Swedish economist to receive the prize for economic sciences along with Friedrich Hayek. He was also the recipient of more than thirty honorary doctorates. His wife Mrs. Alva Myrdal, who was for some time the Swedish ambassador in India, was awarded the Nobel Prize for Peace in 1983. Myrdal published several books.

◇

For their pioneering work in the theory of money and economic fluctuations and for their penetrating analysis of the interdependence of economic, social and institutional phenomena.

VON HAYEK, FRIEDRICH AUGUST
Austria/Great Britain

Von Hayek, Friedrich August, b.—1899, in Vienna, Austria. He was Director of Austrian Institute of Business Cycle Research betwen 1927 and 1931 during which he also lectured at the University of Vienna. In 1931 he was appointed Tooke professor of economic science and statistics at the London School of Economics, a post he held until 1950. During 1950-62, he was professor of social and moral sciences at the University of Chicago. He was professor of economics at the University of Freiburg, West Germany, until 1969, when he was appointed visiting professor of economics at the University of Salzburg, Austria. He still holds this post and is also professor emeritus of the University of Freiburg.

An advocate of neo-liberalism, his contributions cover a wide spectrum of monetary theory, capital theory, price theory, trade cycles, philosophy, politics, law and social justice. He is the author of several books.

1975

PHYSICS

Bohr, Aage / Mottelson, Ben
Rainwater, James

CHEMISTRY

Cornforth, Sir John Warcup
Prelog, Vladimir

PHYSIOLOGY OR MEDICINE

Baltimore, David / Dulbecco, Renato
Temin, Howard Martin

LITERATURE

Montale, Eugenio

PEACE

Sakharov, Andrei

ECONOMIC SCIENCES

Kantorovich, Leonid / Koopmans, Tjalling C.

1975

Physics

For the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection.

Bohr, Aage, b.—June 19, 1922, Copenhagen, Denmark. He is the son of the Nobel Laureate physicist Niels Bohr. He worked as a junior scientific officer in the department of scientific and industrial research, London, 1942-45. Then he joined as a research associate in the Institute of Theoretical Physics, Copenhagen, in 1946.

BOHR, AAGE
Denmark

His work with his famous father dates back to his young age. When his father was smuggled out of Denmark in 1943 to help develop the first atomic bomb at Los Alamos, USA, he took Aage along with him who was only 21 at that time. The father and the son were given code names while they pursued the research on atom splitting. Aage was known as "Jim Baker", his father as "Nicholas Baker". He has received innumerable doctorates and prizes from various scientific institutes of the world. He received the prize along with Mottleson and Rainwater by proposing their collective model of nuclear structure.

Bohr is Professor of Physics, University of Copenhagen, since 1956.

For the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection.

Mottelson, Ben, b.—July 9, 1926, Chicago, Illinois. An American born Danish physicist, Mottelson graduated from Purdue University in 1947 and gained his Ph.D. in theoretical physics from Harvard University in 1950. From Harvard, Mottelson gained a travelling fellowship to the Institute of Theoretical Physics in Copenhagen (now the Niels Bohr Institute). There he worked with Niels Bohr's son, Aage Bohr, on problems of the atomic nucleus. In particular, they considered models of the nucleus and combined the two principal theories current at the time, one

MOTTELSON, BEN
USA/Denmark

based on independent particles regarded as arranged in shells and the other treating the nucleus as a collective entity exhibiting liquid drop-like behaviour and advanced a unified theory. They worked out the consequences of the interplay between the individual particles and the collective motions, specified the structure of the rotational and vibrational excitations and the coupling between them and showed how the collective concepts could be applied to the nuclei of various elements. For this work Mottleson, Bohr and James Rainwater (Bohr's earlier collaborator at Columbia University) shared the prize. Mottelson held a research position in CERN (the European Center for Nuclear Research) from 1953 until 1957, then he returned to Copenhagen to take up a professorship at the Nordic Institute for Theoretical Atomic Physics (NORDITA).

He took Danish nationality in 1973. Together with Aage Bohr, he has published *Nuclear Structure* (2 vols, 1969-75).

For the discovery of the connection between collective motion and particle motion in atomic nuclei and the development of the theory of the structure of the atomic nucleus based on this connection.

Rainwater, James, b.—December 9, 1917, Council, Idaho. An American physicist, he was educated at the California Institute of Technology, and went on to gain his BS, MA and Ph.D. from Columbia University. At Columbia he was physics assistant (1939-42), instructor (1946), assistant professor (1947), associate professor (1949) and professor (1952). In the intervening war years he worked for the office of Scientific Research and Development and on the Manhattan (atom bomb) project. Rainwater's principal academic achievement was in explaining the structure and behaviour of the atomic nucleus. At the time, two independent models existed, each explaining some of the properties of the atom the "shell" model of independent particles, and the "liquid drop" model of collective motion. Rainwater, in collaboration with Aage Bohr, showed how these theories could be unified (1950). Rainwater, Bohr and Benjamin Mottelson are credited with developing a unified theory that reconciled the individual motions of the nuclear particles with the collective behaviour of the nucleus. From 1951 until 1953 and again in the period 1956-61, Rainwater was director of the Nevis Cyclotron Laboratory. Since 1965 he has spent much of his time supervising the conversion of the synchrocyclotron there.

RAINWATER, JAMES
USA

Note: The 1975 prize was awarded jointly to Bohr, Mottleson and Rainwater.

Chemistry

For his work on the stereochemistry of enzyme-catalyzed reactions.

Cornforth, Sir John Warcup, b.—September 7, 1917, Sydney. Australia, An Australian chemist, Cornforth was educated at the universities of Sydney and Oxford where he obtained his D. Phil. in 1941. He spent the war years in Oxford working on the structure of penicillin before joining the staff of the Medical Research Council in 1946. In 1962 Cornforth moved to the Shell Research Center in Kent to serve as director of the Milstead Laboratory of Chemical Enzymology. In 1975 he accepted the post of Royal Society Research Professor at Sussex University.

In 1951 the American chemist Robert Woodward had succeeded in synthesizing the important steroid, cholesterol; Cornforth was interested in how the molecule is actually synthesized in the living cell. Using labeled isotopes of hydrogen, he traced out in considerable detail the chemical steps adopted by the cell to form the $C_{27}H_{45}OH$

CORNFORTH, Sir JOHN WARCUP
Australia and Great Britain

molecules of cholesterol from the initial CH_3-COOH of acetic acid. It was for this work that he shared the prize with Vladimir Prelog. Cornforth has also synthesized alkenes, oxazoles, and the plant hormone abscisic acid.

For his research into the stereochemistry of organic molecules and reactions.

Prelog, Vladimir, b.—July 23, 1906, Sarajevo, Yugoslavia. He was a chemist and his education was in the chemistry department of the Czech Institute of Technology, Prague, and he received the Diploma in Chemical Engineering from there in 1928. In 1929, he was admitted to the Doctorate in Science & Technology by virtue of his research work under the supervision of Prof. E. Votocek. He was the head of the laboratory of G.J. Driza in Prague during 1929-35. He was a *Dozent* at the chemistry department of the Technical University, Zagreb (1935-40). He became an associate professor at the same place (1940-41). In 1942, he emigrated to Switzerland and joined the Swiss Federal Institute of Technology at Zuerich as a *Privatdozent* where he became an associate professor in 1947 and professor in 1950. During 1957-65 he was the head of the Laboratory of Organic Chemistry in the same Institute at Zuerich.

PRELOG, VLADIMIR
Yugoslavia/Switzerland

Note: The 1975 prize was awarded jointly to Prelog and Cornforth.

Physiology or Medicine

For their discoveries concerning the interaction between tumour viruses and the genetic material of the cell.

Baltimore, David, b.—March 7, 1938, New York City. An American molecular biologist, Baltimore studied chemistry at Swarthmore College and continued with postgraduate work at the Massachusetts Institute of Technology and at Rockefeller University, where he obtained his Ph.D. in 1964. After three years of work at the Salk Institute in California he returned to MIT in 1968 where in 1972 he became professor of biology.

Francis Crick had formulated what came to be known as the Central Dogma of molecular biology, namely, that information could flow from DNA to RNA to protein but could not flow backward from protein to either DNA or RNA. Although he had not actually excluded the passage of information from RNA to DNA it became widely assumed that such a flow was equally forbidden. In June 1970 Baltimore and quite independently, Howard Temin announced the discovery of an enzyme, later to be known as *reverse transcriptase*, which is capable of transcribing RNA into DNA. Apparently certain viruses, like the RNA tumour viruses used by Baltimore, could produce DNA from an RNA template. For this work Baltimore shared the prize with Temin and Renato Dulbecco. Earlier (1968) Baltimore had done important work on the replication of the

BALTIMORE, DAVID
USA

polio virus. He revealed that the RNA of the virus first constructed a polyprotein (or giant protein molecule), which then split into a number of smaller protein molecules. Two of these polymerized RNA while the remainder formed the protein coat of the new viral particles.

◇

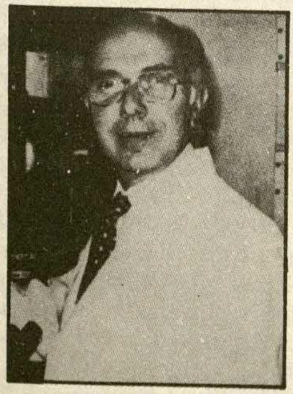
For their discoveries concerning the interaction between tumour viruses and the genetic material of the cell.

Dulbecco, Renato, b.—February 22, 1914, Catanzaro, Italy. Dulbecco studied medicine at Torino University. After obtaining his M.D. degree in 1936, he worked as a medical officer in the army till 1942. In the summer of 1946 Professor Luria (Nobel Laureate) invited him to join his team in Bloomington, Indiana, and he moved to America.

He taught briefly at Indiana before moving to California in 1949, where he served as professor of biology (1952-63) at the California Institute of Technology. He then joined the staff of the Salk Institute. Beginning in 1959 he introduced the idea of cell transformation.

The significance of his work was to provide an experimental set-up where the processes by which a normal cell becomes cancerous can be studied in a relatively simplified form. It was for this work that Dulbecco was awarded the prize.

◇



DULBECCO, RENATO
Italy/USA

For their discoveries concerning the interaction between tumour viruses and the genetic material of the cell.

Temin, Howard Martin, b.—December 10, 1934, Philadelphia. He studied biology at Swarthmore College and at the California Institute of Technology, where he obtained his Ph.D. in animal virology, in 1959. He has worked at the University of Wisconsin since 1960 serving from 1969 as professor of oncology.

TEMIN, HOWARD MARTIN
USA

There are two classes of viruses, those with DNA and those with RNA genes. The former replicate by transforming their DNA into new DNA and transmit information from DNA through RNA into protein. The latter class of viruses replicate RNA into RNA and transmit information directly into protein without the need for DNA. That is, all such reactions fitted into the general sequence DNA to RNA to protein the so-called "Central Dogma" of molecular biology. In the early 1960s Temin discovered a curious feature of the RNA Rous chicken sarcoma virus (RSV). He found that it would not grow in the presence of the antibiotic actinomycin D, a drug known to inhibit DNA synthesis. Temin realized that this might mean the RSV replicated through a DNA intermediate, which he called the provirus. By that Temin was proposing the sequence RNA (of the RSV) to a DNA (provirus) to RNA (replicated RSV) which was not actually excluded by the Central Dogma. If such a reaction did take place then it would certainly require the presence of an enzyme capable of transcribing RNA into DNA. It was not until 1970 that Temin identified the enzyme (discovered independently by David Baltimore) known variously as *reverse transcriptase* or *RNA-directed DNA polymerase*. It was for this work that Temin shared the prize with Baltimore and Renato Dulbecco.

In 1962, Temin married Rayla Greenberg of Brooklyn, a population geneticist and they have two daughters.

Note: The 1975 prize was awarded jointly to Baltimore, Dulbecco and Temin.

Literature

For his distinctive poetry which, with great artistic sensitivity, has interpreted human values under the sign of an outlook on life with no illusions.

Montale, Eugenio, b.—October 12, 1896, Genoa. A poet, prose writer, editor and translator. The noted English poet Stephen Spender complimented him saying that he is the greatest of the living Italian poets.

Initially Montale was taken to be a Hermetic poet like Ungretti and Quasimodo. But in the compositions of his later life he discarded symbolism and expressed himself in pure and simple language. He won many literary awards and many critical acclaims and his poems have been admired and widely translated into many languages. He was a veteran of World War I and was opposed to Fascism in the post-war period. He was the co-founder of *Primo Tempo* (1922) a literary journal. He served as the director of the famous Cabinetto Vieusseux library of Florence, and was the poetry critic of *La Flora Letteraria* (1938-40). In 1948, he became the literary and music editor for the Milanese daily *Corriere della serra*.

MONTALE, EUGENIO
Italy

His first book of poems *Ossia di seppia* (1925, Cuttlefish Bones) expressed open pessimism against the post-war period. It was followed by *La Casa dei doganieri e altre poesie* (1932, The House of the Customs Officer and other Poems), *Le occasioni* (1939, The Opportunities) and *La bufera altro* (1956, The Blizzard and other Poems). He won the Marzotte prize. He translated Shakespeare, T.S. Eliot, and many other English poets.

Peace

Sakharov, Andrei, b.—21, 1921, Moscow. He graduated from the Moscow State University in 1942. He was appointed physicist to the P.N. Lebedev Physics Institute, Academy of Sciences, Moscow (1945-80).

He achieved important breakthrough in controlled nuclear fission leading to the development of the Soviet hydrogen bomb. He established the Human Rights Commission in 1970 and became active in Soviet Human Rights campaign. He was sent in internal exile in 1980. He received the Order of Lenin, Eleanor Roosevelt prize in 1973 and the Stalin prize. He is the second scientist to

SAKHAROV, ANDREI
USSR

receive the peace prize, the first was Linus Pauling (of the USA).

Economic Sciences

For their contributions to the theory of optimum allocation of resources.

Kantorovich, Leonid, b.—January 1912, Leningrad, Russia, d.—April 9, 1986, Moscow. He was educated at Leningrad University as a mathematician. He worked as instructor at Leningrad Institute of Industrial Construction Engineering from 1930 to 1932, and at Leningrad University from 1932 to 1934. He was professor of economics at Leningrad University from 1934 to 1960. Earlier he received his Sc.D. in 1935 from the same university. He was head of the Department of Scientific Instrument Studies, Moscow, from 1961 to 1971. He was also the head of the research laboratory of the Institute of National Economic Control, Moscow, from 1971 to 1976. He was a member of the USSR Academy of Sciences from 1964 to 1971. He has received the Order of Lenin and various other national and international prizes.

KANTOROVICH, LEONID
USSR

It was in 1939 in a paper entitled "Mathematical Methods of Organising and Planning of the Production" that Kantorovich provided his formulation of the activity analysis model and a computational technique for solving related linear programming problems. But it was his *The Best Use of Economic Resources* (published in Russian in 1959, and in English in 1965) that earned him the prize. ◆

For their contributions to the theory of optimum allocation of resources.

Koopmans, Tjalling C., b.—August 28, 1910, Graveland, The Netherlands. He passed his M.A. with physics and mathematics from the Utrecht University in 1933 and received his Ph.D. from the Leiden University in 1936. He served as lecturer in economics in the Netherlands School of Economics up to 1938, when he joined as the Financial Secretary of the League of Nations, Geneva and remained there until 1940. He was lecturer at Princeton University during 1940-41.

KOOPMANS, TJALLING C.
The Netherlands/USA

He worked as associate professor of economics at Chicago University from 1946 to 1948, and professor of economics from 1948 to 1955. He was also with Cowles Commission at Chicago. When the Commission was relocated at Yale University in 1955, he moved with it and was its Director from 1961 to 67.

He holds numerous honorary doctorates and has been a fellow of various institutes and academies. His major publications are *Activity Analysis of Production and Allocation* (1951), *Studies in Econometric Methods* (1953) and *Three Essays on the State of Economic Science* (1957).

1976

PHYSICS

Richter, Burton / Ting, Samuel C.C.

CHEMISTRY

Lipscomb Jr., William Nunn

PHYSIOLOGY OR MEDICINE

Blumberg, Baruch Samuel
Gajdusek, D. Carleton

LITERATURE

Bellow, Saul

PEACE

Williams, Betty / Corrigan, Mairead

ECONOMIC SCIENCES

Friedman, Milton

PHYSICS

Richter, Burton Ting, Samuel C.C.

CHEMISTRY

Lipscomb Jr., William Nunn

PHYSIOLOGY OR MEDICINE

Blumberg, Baruch Samuel

Gajdusek, D. Carleton

LITERATURE

Bellow, Saul

PEACE

Williams, Betty Corrigan, Mairead

ECONOMIC SCIENCES

Friedman, Milton

1976

Physics

For their pioneering work in the discovery of a heavy elementary particle of a new kind.

Richter, Burton, b.—March 31, 1931, New York City. An American physicist. He attended the Far Rockaway High School in Queens and Mercersburg Academy in Mercersburg, Pennsylvania, and entered the MIT in 1948. At MIT he was first undecided between the study of chemistry and physics as his choice of major subject but at the insistence of Professor Francis Friedman he chose to study physics.

RICHTER, BURTON
USA

In the magnet laboratory he worked part time with Professor Martin Deutsch in classical positronium experiments. For his senior thesis he worked under Professor Bitter. Richter intensively studied the quadratic Zeeman effect. In 1952, he got his B.S. degree and entered the Graduate School of the MIT and continued to work under Professor Bitter. He received the Dupont Fellowship in 1952-53 and a National Science Foundation Fellowship from 1953 to 1955. He completed his work for Ph.D. in 1956 on the photoproduction of pi-mesons, unstable elementary particles that have rest masses between those of the electron and the proton.

Richter joined the Department of Physics at Stanford University as a research associate in 1956 and was promoted to assistant professor in 1960, associate professor in 1963 and to full professorship in 1967.

For their pioneering work in the discovery of a heavy elementary particle of a new kind.

Ting, Samuel C.C., b.—January 26, 1936, Ann Arbor, Michigan. While his father was studying at the University of Michigan, he spent his childhood in the mainland of China and later at Taiwan where his father was a professor of the Taiwan University. Ting came back to the USA in 1956 and joined the University of Michigan as a student where he received BS in engineering in 1959, MS in physics in 1960 and his Ph.D. in 1962. He worked for a while in the Centre Europeen de

TING, SAMUEL C.C.
USA

Researches Neuclear (CERN) near Geneva, Switzerland, and at the Columbia University, at the latter he was assistant professor of physics. He joined the MIT in 1967. He conducted research with his associates in 1974 at the Brookhaven National Laboratory where they generated a new atomic particle by bombarding stationary targets with beams of protons. A similar particle was also independently generated by Burton Richter's group at the Stanford Linear Acclerator some 3000 mile apart.

Note: The 1976 prize was awarded jointly to Richter and Ting.

Chemistry

For his studies on the structure of boranes illuminating problems of chemical bonding.

Lipscomb Jr., William Nunn, b.—December 9, 1919, Cleveland, Ohio. An American inorganic chemist. He was educated at the University of Kentucky (graduating in 1942) and the California Institute of Technology where he obtained his Ph.D. in 1946. He worked at the University of Minnesota from 1946 to 1959 being appointed professor of chemistry in 1954. In 1959 he moved to the chair of chemistry at Harvard.

Lipscomb is best known for his work on boranes, hydrides of boron, first investigated by Alfred Stock in the early part of the century. Boranes have such typical formulae as $B_2H_6B_4H_{10}$, $B_{10}H_{14}$ and B_{18},H_{22} which immediately appear to the chemist as analogous to the comparable hydrocarbon series, CH_4,C_2H_6,C_4 H_{10} etc. However as boron has only three electrons in its outer shell it was difficult to see how the covalent electron pair bonds could work with boron hydrides. Using low temperature X-ray diffraction analysis Lipscomb tackled the problem of investigating the notoriously unstable boranes, producing evidence of some remarkable structures, totally original and completely unsuspected by earlier chemists. The basic concept of a three center bond was derived from a structure for diborane proposed by H.C. Longuett Higgins. This differs from the normal covalent bond found in hydrocarbons where adjacent carbon and hydrogen atoms share two electrons. In a three center bond, a pair of electrons is shared equally by three atoms.

LIPSCOMB Jr., WILLIAM NUNN
USA

Lipscomb's work on boron hydrides involved new techniques that proved to have a wider application in chemistry and produced results that led to the formulation of more general theories. In particular Lipscomb produced a theory of chemical effects in nuclear magnetic resonance studies of complex molecules. He also worked on the quantum mechanics of large complex molecules. His group has also applied low-temperature X-ray diffraction techniques to other substances, including single crystals of such gases as oxygen and nitrogen, other inorganic compounds, and naturally occurring organic compounds. More recently he has turned to determinations of the structures of proteins, enzymes, and other substances of biochemical interest.

Physiology or Medicine

For their discoveries concerning new mechanisms for the origin and dissemination of infectious diseases.

Blumberg, Baruch Samuel, b.—July 28, 1925, New York City. A physician who received the prize along with D. Carleton Gajdusek.

After graduating from the Far Rockaway High School he served in US Navy. He studied physics at Schenectady, New York. In 1946 he took his B.Sc. from the Union College and joined the Columbia University College of Physicians and Surgeons from where he took his M.D. in 1951. He

BLUMBERG, BARUCH S.
USA

received his Ph.D. in biochemistry from the Oxford University, England. He researched on Geographic medicine and travelled to many countries in the East and West. He contributed to the enhancement of medical knowledge of Hepatitis-B and its prevention. He is the first to find out the cause of "Kuru", a slow virus disease found among cannibal women of a clan in New Guinea, who devour the brains of their women relatives dying from "Kuru". The condition is a slow-virus disease affecting the cannibal women and not the menfolk of the clan.

◆

For their discoveries concerning new mechanisms for the origin and dissemination of infectious diseases.

Gajdusek, D. Carleton, b.—September 9, 1923, Yonkers, New York. He graduated in science from the University of Rochester, Minnesota, in 1943 and obtained his M.D. degree from the Harvard University Medical School in 1946. He later became a board certified paediatrician. He joined as research worker in the California Institute of Technology in 1948 and engaged himself in virological research.

GAJDUSEK, D. CARLETON
USA

By virtue of his virological researches he identified and isolated the slow-virus causing the dreaded "Kuru" disease occurring among a particular group of cannibalistic people in New Guinea. It was for this epoch-making discovery he was awarded the prize along with his fellow American B.S. Blumberg.

Note: The 1976 prize was awarded jointly to Blumberg and Gajdusek.

Literature

For the human understanding and subtle analysis of contemporary culture that are combined in his work.

Bellow, Saul, b.—July 10, 1915, Lachine, Quebec, Canada. A novelist and a professor whose characterization of the modern urban man place him in the forefront of the post-war American authors.

BELLOW, SAUL
USA

He was brought up in a Jewish household and was fluent in Yiddish which influened his writing style.

His parents emigrated from Russia in 1913 and came to Canada, where he spent his early boyhood in a Montreal slum. When he was nine, his family moved to Chicago. He attended the University of Chicago and the Northwestern University, from where he graduated in 1938. He combined writing with a teaching career and taught in various Universities like Minnesota, Princeton, New York, and Chicago.

He gained reputation as a writer with his first novels *Dangling Man* (1944) and *The Victim* (1947). *The Adventures of Augie March* (1953) brought him further acclaim and the National Book Award. *Henderson the Rain King* (1959) described the tale of an eccentric American millionaire on a safari to Africa. *Mr. Sammler's Planet* (1970) and *Humboldt's Gift* (1975) are authentic studies on Jewish intellectuals. *Seize the Day* (1956) is a novella which is a unique description of man failing in the society. He also wrote a full-length play, *The Last Analysis* (1964), and a volume of short stories, *Mosby's Memories and Other Stories* (1968).

He has won many national and international awards and honours including the Pulitzer Prize, Prix International de Litterature (1965) and the Malaparle Literary award (1984). He is a fellow of the American Academy of Arts and Sciences.

Peace

The Nobel Prize for peace in 1976 went to two women of Belfast, Northern Ireland, who organized the Community of Peace People in Northern Ireland. They are Mairead Corrigan (32) and Betty Williams (34).

WILLIAMS, BETTY
Northern Ireland, Great Britain

In August 1976, a British soldier shot at the driver of an Irish Republican Army getaway car. The car went out of control, and killed three children. Mairead Corrigan was their aunt who publicly condemned the Irish Republican Army for the death of those innocent children. Betty Williams, a mother who lived near the vicinity, went door to door requesting the neighbours to demonstrate against the violence. Two hundred people joined the two protesting women and staged a peaceful march to declare war on the fratricidal war. A week later, 10,000 Protestants and Catholics together staged another march despite the cries of threats from the feuding parties. They formed an informal group and decided to condemn all violence from either the Ulster Defence Association (UDA) or the Irish Republican Army (IRA). This unique peace movement dramatically decreased violent deaths in Northern Ireland. Even though the movement was in its initial stages, the Nobel Peace Prize committee thought it worthwhile to reward those two brave women who dared to face the violent IRA and UDA engaged in coldblooded political manslaughter.

CORRIGAN, MAIREAD
Northern Ireland, Great Britain

Economic Sciences

For his achievements in the fields of consumption analysis, monetary history and theory and for his demonstration of the complexity of stabilization policy.

Friedman, Milton, b.—July 31, 1912. Brooklyn, New York. An economist who majored in economics at the Rutgers University and won a prize in mathematics. He took his B.A. from Rutgers in 1932, and M.A. from the Chicago University in 1933.

He remained at Chicago as a research assistant until 1935. During 1935-37, he was with the Natural Resources Committee, Washington, as associate economist, and with the National Bureau of Economic Research, New York, during 1937-40. During 1940-41, he was visiting professor of economics at the University of Wisconsin and during 1941-43, he served as principal economist, Tax Research Division, US Treasury Department.

FRIEDMAN, MILTON
USA

In 1943, he moved to Columbia University and worked as associate director of its Statistical Research Group Division of War Research up to 1945. In 1946, he was awarded Ph.D. degree by Columbia University and the same year he joined Chicago University as an associate professor of economics and statistics and became a full professor in 1948. He was an economic columnist of *Newsweek* from 1966 to 1984. He holds several honorary doctorates, and has been the recipient of many fellowships and awards. He has been a member of numerous societies of the Chicago School, he played a leading role in revitalizing the quantity theory of money. He is a prolific writer and the author of several books.

1977

PHYSICS

Anderson, Philip W. / Mott, Sir Nevill F.
Van Vleck, John H.

CHEMISTRY

Prigogine, Ilya

PHYSIOLOGY OR MEDICINE

Guillemin, Roger / Schally Andrew
Yalow, Rosalyn

LITERATURE

Aleixandre, Vicente

PEACE

Amnesty International

ECONOMIC SCIENCES

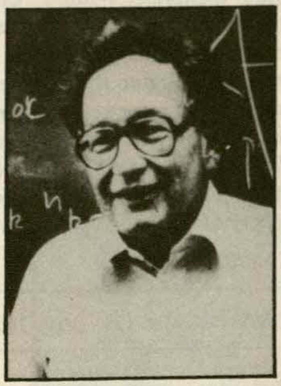
Ohlin, Bertil / Meade, Sir James

1977

Physics

For their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems.

Anderson, Philip W., b —1923, Indianapolis, Indiana. A physicist associated with the Bell Telephone Laboratories and the Princeton University. He was a student of Van Vleck at Harvard and later as a visiting professor to the Cavendish Laboratories, Cambridge, a colleague of Mott. His diverse contributions to physics consists of methods of deducing molecular interactions from the shapes of spectral peaks; extension of the "Bardeen-Cooper-Schrieffer theory" to account for the effects of impurities on the properties of superconductors. Along with Mott he dealt with the semiconducting properties of disordered solid materials.



ANDERSON, PHILIP W.
USA

Their works were independent but closely related and contributed to the understanding of the behaviour of electron in magnetic noncrystalline solids. Their researches have improved the qualities of modern tape recorders, office copying machines, high speed computers, lasers and solar energy converters.

◆

For their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems.

Mott, Sir Nevill F., b.—1905, Leeds. A physicist who played an important part in the wholesale reformulation of physics which followed the origin of wave mechanics. He worked with Niels Bohr (Nobel Laureate) and Lord Rutherford (Nobel Laureate). In 1933 he changed from the study of nuclear physics to the study of metals, semiconductors, photographic emulsions and electrical conductions in noncrystalline solids. He was the professor of theoretical physics at the University of Bristol. From 1954 to 1971 he researched in the Cavendish Laboratories, Cambridge.

MOTT, Sir NEVILL F.
Great Britain

◆

For their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems.

Van Vleck, John H., b.—13 March, 1899, Middletown, Connecticut, d.—November 1980, Cambridge, Massachusetts, USA. A mathematician and natural philosopher who was the Hollis professor of mathematics and natural philosophy in the Harvard University. He is well known in the scientific world as the "Father of Modern Magnetism". One of his major achievements was the refinement of the technique to give an accurate explanation of the magnetic properties of individual atoms of whole series of chemical elements. During 1930, he formulated the "ligand field theory" which accounts for magnetic, electrical and optical properties of many elements and compounds. The theory is one of the most useful means for a chemist in the proper understanding of the patterns of chemical bonds. He published *The Theory of Electric and Magnetic Susceptibilities* in 1932, it is a standard text in the field. He formed the basis for the development of computer memory systems.

VAN VLECK, JOHN H.
USA

Note: The 1977 prize was awarded jointly to Anderson, Mott and Van Vleck.

Chemistry

For his contributions to non-equilibrium thermodynamics, particularly the theory of dissipative structures.

Prigogine, Ilya, b.—1917, Moscow. He immigrated to Western Europe with his family in 1921. The family settled in Belgium in 1929. He is a physical chemist and theoretical physicist and was awarded the prize for widening the scope of thermodynamics. Thermodynamics was formulated in the 19th century and has since been relevant to physics, chemistry, biology and engineering.

PRIGOGINE, ILYA
Belgium

Prigogine's work has made thermodynamic principles applicable to many disciplines including sociology, ecology and demography. The laws of thermodynamics govern a host of phenomena and accurately account for the qualities of physical systems under conditions of equilibrium. After World War II he developed mathematical models known as the "dissipative systems" which showed how matter and energy could interact creatively, forming organisms which can sustain themselves and grow in opposition to the drift towards universal chaos. He is at present professor of physical chemistry and theoretical physics at the Free University of Brussels and also Director of the Centre for Statistical Mechanics and Thermodynamics at the University of Texas, Austin, USA.

Physiology or Medicine

For their discoveries concerning the peptide hormone production of the brain.

Guillemin, Roger, b.—1924, Dijon, France. A biochemist, now on the staff of the Salk Institute of Biological Studies, San Diego, California. He joined the staff of the Baylor College of Medicine in Houston. Texas, on a project to verify the proposal made by the deceased British anatomist Geoffrey W. Harris, that the secretion of the pituitary gland was dependent on the concentration of other hormones secreted by the hypothalamus. He was assisted in his research by Andrew Schally who joined him in 1957 and they together separated various fragments of the brain of about seven million sheep and pigs.

GUILLEMIN, ROGER
USA

In 1973 he found *somatostatin,* a hormone which is being studied for the treatment of diabetes and peptic ulcers.

◇

For their discoveries concerning the peptide hormone production of the brain.

Schally, Andrew, b.—1926, Wilno, Poland (now Vilnius, the capital of Lithunia). He fled with his family to Britain in 1939. Later he accepted a research assignment with Guillemin in the Baylor College of Medicine, Houston, Texas. Initially, he and Guillemin endeavoured to isolate the substance which regulated the secretion of Adrenal Corticotropic Hormone (ACTH). Later, he went to New Orleans where he succeeded in isolating *thyrotropic hormone releasing factor*. Guillemin also found it independently.

SCHALLY, ANDREW
USA

Their later researches materialized in the discovery of the *luteinizing hormone releasing factor* in 1971.

◇

For the development of radioimmunoassays of peptide hormones.

YALOW, ROSALYN
USA

Yalow, Rosalyn, b.—July 19, 1921, Bronx, New York. A biochemist on the staff of the Bronx Veterans Administration Hospital and the Mount Sinai School of Medicine, New York City. She received the prize along with Guillemin and Schally in recognition of her role in the development of "radioimmunoassay". It is a very sensitive specific technique used for measuring the concentration of various biologically active substances, which are present in the human body in such infinitesimal quantities that so far they were practically undetectable by any other methods of assay.

She and her deceased colleague Solomon Berson were engaged for the past 22 years in the study of the resistance to insulin among some diabetics. They found by radioimmunoassay that in those subjects the immune system of the individual produces an antibody against insulin which neutralises the foreign protein. It was found that insulin was capable in forming an antibody resisting its action in *vivo* also.

Note: The 1977 prize was awarded jointly to Guillemin, Schally and Yalow.

Literature

For a creative poetic writing which illuminates man's condition in the cosmos and in present-day society, at the same time representing the great renewal of the tradition of Spanish poetry between the wars.

Aleixandre, Vicente, b.—April 26, 1898, Seville, Spain, d.—December 14, 1984, Madrid. A Spanish poet who was educated in Madrid and belonged to the "Generation of 1927," a school of young writers who had their inspiration from the 16th and 17th century literature of Spain.

ALEIXANDRE, VICENTE
Spain

During Spanish Civil War he could neither fight nor flee as he was chronically ill. So, he remained in the republican held territory and after the war was denigrated by General Franco. He was forbidden to publish his works for five years even though he had received the highest literary award of Spain before the onset of the Civil War. His works have been described as surreal and have been translated into French, German and English.

Among his best known publications are *Espados como Labios* (1939, Swords as Lips), *Destruction of Love* (1933), *Passion of Earth* (1935), *Sombra del paraiso* (1944, Shadow of Paradise), *Historia del corazon* (1954, Story of the Heart) and *Dialogue del conocimiento*. (1974, Dialogues of Insight).

In 1974 his name was recommended for a Nobel Prize but Spanish political considerations ruled out his selection. In spite of that he was awarded the prize in 1977. A few days after receiving the prize the Spanish King, Juan Carlos, visited him and honoured him with the Grand Cross of the Order of Carlos III.

Peace

AMNESTY INTERNATIONAL
London, Great Britain

The prize was awarded to Amnesty International, an organization that works on behalf of political prisoners all over the world. The organization was founded in 1961 by Peter Beneson, a lawyer of London. Sean MacBride, who received the prize for peace in 1974, was its chairman from 1961 to 1975.

It has now over 200,000 members in 107 nations of the world. It works for the release of any prisoner who is jailed for political or religious reasons. It has pleaded the cases of over 16,000 men and of which 10,000 have been released. It works on a modest budget. Its office works in over 21 languages. When a particular person is affected he is adopted by the organization and the government involved is teased and annoyed by onrushes of mails from all over the world. Soon the issue is raised and discussed on the Government level and the person receives proper attention and justice.

Economic Sciences

For their pathbreaking contribution to the theory of international trade and international capital movements.

Ohlin, Bertil, b.—April 23, 1899, Kippan, Sweden, d.—1979. A prodigious Swedish economist who entered the college at the age of 15 and became a professor at the University of Copenhagen at the age of only 25 where he remained from 1924 to 1929. Thereafter, he went to Stockholm University as professor of economics and worked there until 1965. He was a member of the Swedish parliament from 1938 to 1962.

OHLIN, BERTIL
Sweden

In 1944, he became the leader of the Swedish Liberal Party and held this position for 23 years, serving as Minister of Commerce in 1944-45. He extended the theory of international trade originally developed by his teacher E. Heckscher which is known as the 'Heckscher-Ohlin principle'. He was the recipient of honorary doctorates from a number of universities. He was the second Swedish economist to receive the prize for economic sciences along with the British economist James Meade for his contribution to the theory of international trade and international capital movements. His major works are: *The Theory of Trade* (1931), *Interregional and International Trade* (1933), *Foreign Trade and Foreign Policy, The Problem of Employment Stabilisation* (1949), and *The International Allocation of Economic Activity* (1977).

◆

For their pathbreaking contribution to the theory of international trade and international capital movements.

Meade, James, b.—1907. He was educated at the universities of Oxford and Cambridge. He was a member of the Economic Secretariat at the League of Nations, Geneva, from 1938 to 1940 He was a member and then the head of the British Government's Economic Secretariat during 1945-47. In 1947, he joined the London School of Economics as professor of foreign trade and remained there until 1957.

MEADE, Sir JAMES
Great Britain

In 1957, he joined Cambridge University as professor of political economy, and retired in 1974. Since then he has been the Chairman of the Institute of Fiscal Studies. Earlier, he was knighted by the Queen. He has been a fellow of a number of institutes, associations and academies.

James Meade based his observations upon the foundations laid by Bertil Ohlin and demonstrated the effect of domestic economic policy on foreign trade and penetrated the problems of stabilization policies in open economies. He showed that tax cuts adversely affect the balance of payments and how monetary policy and exchange rates affect economic stabilization. His principal publications are: *Planning and the Price Mechanism* (1948), *The Theory of International Economic Policy* (Vol. I, 1951, Vol. II, 1955), *A Geometry of International Trade* (1952), and *A Neo-classical Theory of Economic Growth* (1960).

Note: The 1977 prize was awarded jointly to Ohlin and Meade.

1978

PHYSICS

Kapitsa, Peter Leonidovitch
Penzias, Arno A.
Wilson, Robert Woodrow

CHEMISTRY

Mitchell, Peter D.

PHYSIOLOGY OR MEDICINE

Arber, Werner / Nathans, Daniel
Smith, Hamilton Othanel

LITERATURE

Singer, Isaac Bashevis

PEACE

Begin, Menachem / Sadat, Mohamed Anwar

ECONOMIC SCIENCES

Simon, Herbert A.

1978

Physics

For his basic inventions and discoveries in the area of low-temperature physics.

Kapitsa, Peter Leonidovitch, b.—July 8, 1894, near St. Petersburg (now Leningrad), d.—April 8, 1984, Moscow. A Russian physicist, was trained at the local Polytechnic Institute. In 1921 he gained admission into the Cavendish Laboratory at Cambridge for study under Ernest Rutherford. There he took up the investigation of the properties of materials subjected to extremely low temperatures or to intense magnetic fields. By 1924, he built a magnet producing a field of 50,00,000 gauss. He designed an apparatus which could produce liquid helium at an unprecedented rate of two litres per hour. The prototype of his apparatus is used all over the world today wherever cryogenics is studied. In 1934, his foreign travels were forbidden by the Russian Government with the confiscation of his and his wife's passports. He was almost incarcerated as the Director of the Vasilov Institute of Physics under the Soviet Academy of Sciences. He built a cryo laboratory there and resumed his studies on helium. During World War II he guided the production of liquid oxygen for use in the Soviet steel plants. Due to his pacifist ideas antagonizing the manufacture of atom bombs he was disliked by Stalin and Lavrenty Beria and was dismissed from the Directorship of the Vasilov Institute. But in 1955, he was reinstated to his former position. He was also engaged in researches on plasma physics. ◆

KAPITSA, PETER LEONIDOVITCH
USSR

For their discovery of cosmic microwave background radiation.

Penzias, Arno A., b.—1933, Munich. A physicist who went to the USA with his parents in 1940 and studied at the City College of New York and the Columbia University. He joined the Bell Telephone Laboratories in 1961. He and Robert W. Wilson started investigating the intensity of radio waves emitted from the gaseous halo that surrounds our galaxy. They designed a big horn

PENZIAS, ARNO A.
USA

shaped antenna and with its help detected microwave radiation from the Milky Way, the gases in the Earth's atmosphere and various other sources. Their findings indicate a cosmic background temperature of about 3°K. Their research have clarified many unknown facts in the fields of cosmology.

◆

For their discovery of cosmic microwave background radiation.

Wilson, Robert Woodrow, b.—January 10, 1936, Houston, Texas. An American astrophysicist. Wilson studied at Rice University, Houston, where he gained his BA in physics in 1957, and went on to obtain his Ph.D. from the California Institute of Technology in 1962. He joined the Bell Laboratories, Holmdel, New Jersey, in 1963 and became head of the radiophysics research department in 1976. It was at the Bell Laboratories that he and his co-worker Arno Penzias found the first evidence in 1964 of cosmic microwave background radiation, which is now widely interpreted as being the remnant radiation from the "big-bang" creation of the universe several billion years ago. Wilson is continuing his astrophysics work with Penzias, looking for interstellar molecules and determining the relative abundances of interstellar isotopes.

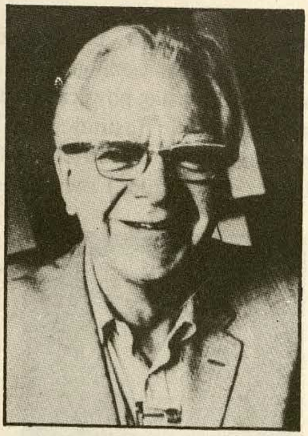
WILSON, ROBERT W.
USA

Note: The 1978 prize was divided, one-half being awarded to Kapitsa and the other half jointly to Penzias and Wilson.

Chemistry

For his contribution to the understanding of biological energy transfer through the formulation of the chemiosmotic theory.

Mitchell, Peter D., b.—September 29, 1920, Mitcham, England. A British biochemist who was educated at the University of Cambridge. Since his student days at the University he was endeavouring to work out a theory of how the cells of living beings transfer oxygen and sunlight into the essential compound adenosine triphosphate (ATP).



MITCHELL, PETER D.
Great Britain

The compound activated innumerable metabolic processes of living creatures as simple as a bacterium to the highly complex human body or the giant sequoia. ATP has been named by some as the currency of exchange within the domain of a cell. He proposed that enzymes already known to be fixed within the cell membranes are oriented in such a way that as one of them brings about the conversion of adenosine diphosphate to adenosine triphosphate (ADP to ATP), liberating protons, another enzyme simultaneously effects on oxidation-reduction reaction which uses up the protons.

Mitchell's ideas have already proved worthwhile by unifying and refocussing the research which are in progress in this intricate field of biochemistry.

Physiology or Medicine

For the discovery of restriction enzymes and their application to problems of molecular genetics.

Arber, Werner, b.—1929, Granichen, Switzerland. A microbiologist who studied at the Swiss Federal Institute of Technology at Zuerich, the University of Geneva and the University of Southern California. He served on the faculty of the Geneva University from 1960 to 1970. He had been professor of microbiology at the university from 1960 to 1970. He had been professor of microbiology at the University of Basel since he left the job at Geneva.

ARBER, WERNER
Switzerland

He researched on the phenomenon of host induced variation after its discovery by Salvador Luria (Nobel Laureate) and developed further knowledge of action of one of the "restriction enzymes" which are protective enzymes present in bacterium that modified the DNA of infesting viruses. ◇

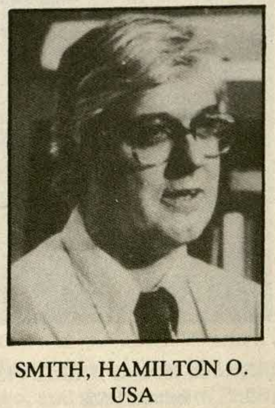
For the discovery of restriction enzymes and their application to problems of molecular genetics.

Nathans, Daniel, b.—1928, Wilmington, Delaware. A microbiologist who attended the University of Delaware and Washington University, St. Louis, Missourie. He has been a member of the Faculty of the Johns Hopkins University since 1967. Nathans recognized the potential usefulness of a specific enzyme in cutting up the DNA of the simian virus (SV 40). In 1971, he further showed that the enzyme found by Hamilton O. Smith broke the above molecule into 11 well-defined fragments. By employing two more of these enzymes he broke viral DNA at other positions and deduced its entire constitution. This achievement, the construction of a genetic map of virus, started the first application of new enzymes in the identification of the molecular basis of cancer. ◇

NATHANS, DANIEL
USA

For the discovery of restriction enzymes and their application to problems of molecular genetics.

Smith, Hamilton Othanel, b.—August 23, 1931, New York City. An American molecular biologist. Smith studied at the University of Illinois, graduated in mathematics (1952) from the University of California, Berkeley, and took his MD



SMITH, HAMILTON O.
USA

from Johns Hopkins in 1956. He taught at the University of Michigan but returned to Johns Hopkins in 1973 as professor of microbiology.

In 1970 Smith succeeded in confirming the hypothesis of Werner Arber to explain the phenomenon of host controlled variation in phages. He identified an enzyme extracted from the bacterium Hemophilus influenzae, later to be known as Hind II, which cut DNA at a specific site. This was the first of the so-called restriction enzymes to be identified, by 1978 over 80 were known. Such enzymes, by permitting the controlled splitting of genes, opened up the possibility of the genetic engineering so energetically pursued from the 1970s onward.

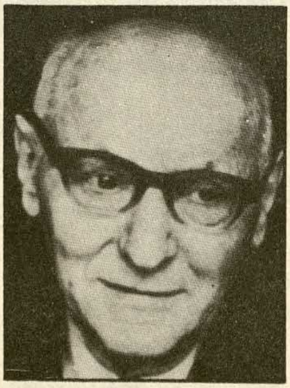
Note: The 1978 prize was awarded jointly to Arber, Nathans and Smith.

Literature

For his impassioned narrative art which, with roots in a Polish Jewish cultural tradition, brings universal human conditions to life.

Singer, Isaac Bashevis, b.—July 14, 1904, Radyzmin, Poland. He was born in a family of rabbis and grew up in Warsaw. He translated *The Magic Mountain* in Yiddish. Due to Nazi persecution, he and his brother fled to New York where he worked for the Jewish daily *Forward* in which his famous novel *The Family Moskat* was serialized.

He won two National Book Awards after publishing eight novels, ten children's short stories, four memoirs and scores of other short stories. Most of his works were in Yiddish and were later translated into English by Saul Bellow and his brother. He is the most powerful Jewish writer.



SINGER, ISAAC BASHEVIS
Poland/USA

His most celebrated works include *In My Father's Court* (1966), *Gimpel the Fool* (1957), *A Day of Pleasure: A Crown of Feathers and Other Stories* (1974). He is a member of American Academy of Arts and Sciences, and a fellow of the Jewish Academy of Arts and Sciences.

Peace

Begin, Menachem, b.—August 16, 1913, Brest-Litovsk, Poland. He was educated in the Mizrachi Hebrew School and the Polish Gymnasium. He entered Warsaw University in 1931 and took his law degree in 1935.

BEGIN, MENACHEM
Poland/Israel

Till the age of 13 he belonged to the *Hashomer Hatza'ir* scout movement, and at the age of 16 joined *Betar*, the nationalist youth movement associated with the Zionist Revisionist Movement. In 1932, he became head of the Organization Department of Betar for Poland, travelling throughout the country on behalf of the movement and contributing many articles to their press. He was also delegated to Czechoslovakia to head the movement there.

In 1937, he returned to Poland, and was imprisoned for a time for leading a demonstration against British policy in Eretz Israel. He organized groups of Betar members who set out for Eretz Israel as "illegal immigrants".

In 1939, Menachem Begin became head of the movement in Poland. On the outbreak of World War II he was arrested by the Russian NKVD and in 1940-41 was confined in concentration camps in Siberia. He was subsequently released under the Stalin-Sikorski agreement.

On regaining his freedom, Begin joined the Polish army and in 1942 his brigade was posted to Eretz Israel. Here he was reunited with his wife, Aliza, who had arrived in the country in 1941. After demobilization he assumed command of the *Irgun Zva'i Leumi* (IZL, the "National Military Organization"). In this capacity he directed the IZL's operations against the British from his underground headquarters and the Mandatory Government offered a prize of 10,000 Sterling for information leading to his arrest. Living in disguise in Tel Aviv he was not captured. In 1947, he met with several members of the United Nations Inquiry Committee and the foreign press in secret to explain his movement's outlook.

After the establishment of the State of Israel, he and his colleagues founded the Herut Movement, and he headed that party's list of candidates for the Knesset. He has been a member of the Knesset since the first elections. On 1 June 1967, the eve of the Six Day War, Begin joined the Government of National Unity, serving as Minister without Portfolio until August 4, 1970. On June 20, 1977, he presented his coalition to the Knesset and won the vote of confidence that made him Minister

His books include *White Nights* (describing his wartime experience in Europe) and *The Revolt,* which has been translated into several languages.

He was awarded the prize for initiating peace in between Israel and Egypt against violent opposition from Syria, Lebanon, Iraq, Saudi Arabia and the Palestinian Arabs.

◆

SADAT, MOHAMED ANWAR
Egypt

Sadat, Mohamed Anwar, b.—December 25, 1918, al Minufiyah, Egypt. An army officer and politician who became president of Egypt in October 1970, after the death of Gamal Abdel Nasser. He was an early associate of Nasser. He worked to overthrow Egypt's British dominated monarchy, and was imprisoned for contacts with the Germans during World War II.

After the revolution of 1952, he held prominent post under Nasser, and was vice-president. As president, his main preoccupation was the continuing confrontation with Israel. Feeling that the Soviet Union was giving him inadequate support, he expelled Soviet technicians and advisers from the country in 1972. Later he assumed the premiership and also became military governor. A war budget was adopted, and Sadat worked for Arab economic and military solidarity.

After the Arab-Israeli war of October 1973, Sadat participated in efforts to find a lasting solution to the problems of the Middle East. He engineered a peace treaty between Egypt and Israel against violent opposition from other Arab countries and the Muslim countries of the world. He was assassinated by a group of Arab fanatics while witnessing a military parade in Cairo on October 6, 1981.

Note: The 1978 prize was awarded jointly to Sadat and Begin.

Economic Sciences

For his pioneering research into the decision-making process within economic organizations.

Simon, Herbert A., b.—June 15, 1916, Milwaukee, Wisconsin. He was educated at the University of Chicago where he earned his doctorate in political science in 1943. He worked for some time in the International City Manager's Association, Chicago, and the Bureau of Public Admini-

SIMON, HERBERT A.
USA

stration, California, and later joined the faculty of the Illinois Institute of Technology, Chicago. In 1949, he moved to the Carnegie-Mellon University in Pittsburgh, Pennsylvania, where he was the R.K. Mellon professor of computer science and psychology until 1962. During 1962-65, he was professor of administration and psychology. He was the Chairman, Division of Behavioural Sciences of National Research Council, during 1967-69. He was a member of President's Science Advisory Committee. He was also a member of the Editorial Advisory Board of the *International Encyclopaedia of Social Sciences* (1968) and also contributed many articles to it. He has been a fellow of a number of academies, institutes and associations. He is also the recipient of numerous awards and honorary doctorates. He made enormous contributions in the theory of science, applied mathematics, statistics, and business administration. He never held a teaching post in economics. In his epoch-making book *Administrative Behaviour* (1947), he described the company as an adaptive system of physical, personal and social components which are held together by a network of intercommunications and by the willingness of its members to cooperate and to strive towards a common goal. He has published several books.

1979

PHYSICS

Glashow, Sheldon L.
Salam, Abdus / Weinberg, Steven

CHEMISTRY

Brown, Herbert C. / Wittig, Georg

PHYSIOLOGY OR MEDICINE

Cormack, Allan M. / Hounsfield, Sir Godfrey N.

LITERATURE

Elytis, Odysseus

PEACE

Mother Teresa

ECONOMIC SCIENCES

Schultz, Theodore W. / Lewis, Sir Arthur

1979

Physics

For their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current.

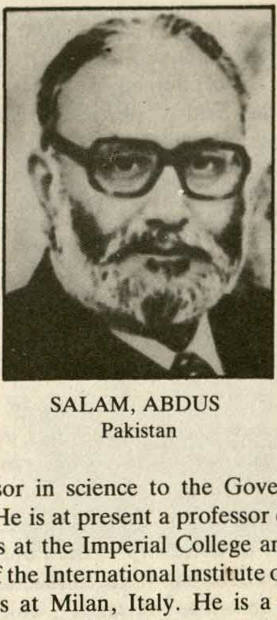
Glashow, Sheldon L., b.—1932, New York City. An American physicist and a professor at the Massachusetts Institute of Technology. His early education was in the famous Bronx High School of Science in Bronx, New York. There he was the classmate of Steven Weinberg. He and Weinberg graduated from the Cornell University. Both were students of the Nobel Laureate Julian Schwinger at Cornell. Glashow worked on the link between electromagnetic force and the "weak" nuclear force. He received the prize along with his pal Steven Weinberg and Abdus Salam of Pakistan. ◇

GLASHOW, SHELDON L.
USA

For their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current.

Salam, Abdus, b.—January 29, 1926, Jhang, Pakistan.

He received a Ph.D. in mathematics from the Cambridge University and took up a teaching post in the Imperial College of Science and Technology, London. He became a Fellow of the Royal Society at the young age of only 31 (the youngest fellow so far). He made a number of discoveries in symmetrics of particles, the most famous of which is "Omega-minus". Since 1961, he has been chief advisor in science to the Government of Pakistan. He is at present a professor of theoretical physics at the Imperial College and also the Director of the International Institute of Theoretical Physics at Milan, Italy. He is a scholar in Arabic, Persian and Urdu and a devout Muslim in the tradition of his religious family. He is the second Nobel Laureate in Physics after Sir C.V. Raman (1930) from the Indian sub-continent. ◇



SALAM, ABDUS
Pakistan

For their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current.

Weinberg, Steven, b.—1933, New York City. An American physicist and a professor at the Harvard University. He was in the same class with Glashow at the Bronx High School of Science, New York.

WEINBERG, STEVEN
USA

They also graduated together from the Cornell University after studying under Dr. Julian Schwinger, the Nobel Laureate in physics. He worked in the similar field of physics as Glashow and Abdus Salam of Pakistan.

Note: The 1979 prize was awarded jointly to Glashow, Salam and Weinberg.

Chemistry

For their development of the use of boron and phosphorus-containing compounds, respectively, into important reagents in organic synthesis.

Brown, Herbert C., b.—May 22, 1912, London. A professor of chemistry at the Purdue University, Indiana. He had been conducting research on what is known as "Boranes", which are compounds of boron and hydrogen, for the last 40 years.

He is renowned for his theoretical contributions to carbocation chemistry. It was a book entitled *Hydrides of Boron and Silicon* which was presented to him by his future wife that launched him into the field of research on "Boranes". He, initially worked in the University of Chicago on the subject and developed 50 compounds of borane for use as drugs, pesticides and in the development of atomic energy. Presently, he is busy in developing a new class of pesticides, which mimics the nature to mislead the insects. His research has also helped in the development of hydrocortisones, steroids and prostaglandins, which are of immense value in the treatment of human diseases.

BROWN, HERBERT C.
USA

◆

For their development of the use of boron, and phosphorus-containing compounds, respectively, into important reagents in organic synthesis.

Wittig, Georg, b.—1897, Berlin, d.—August 26, 1987, Heidelberg. A German chemist who displayed talent both for science and music in his youth. He chose the career of a professional chemist and entered the University of Tuebingen, still retaining his love for playing the piano. He

WITTIG, GEORG
Germany

graduated from the University of Marburg in 1923 and received a doctorate in 1926. He taught at Marburg till 1932 and then moved to the *Technische Hochschule* at Braunschweig and to the University of Freiburg in 1937.

He is renowned for the "Wittig Reagent", a group of phosphorus based compounds which he developed in 1954. He moved on to the University of Tuebingen in 1944 and lastly to the University of Heidelberg in 1956. Wittig made his mark with compounds of phosphorus an element uncommon in organic chemistry. His technique of employing phosphorus compounds in the mass production of vitamin is unique. He became deaf in later years and received the prize at the ripe age of 83 years!

Note: The 1979 prize was awarded jointly to Brown and Wittig.

Physiology or Medicine

For the development of computer assisted tomography.

Cormack, Allan M., b.—1924, Johannesburg, South Africa. A professor of physics at the Tufts University, Massachusetts, USA. He had his early education at the University of Cape Town, South Africa. It was during a prolonged hospitalization in a Cape Town hospital that he realized the limitations of conventional two-dimensional X-ray technique and decided to improve upon it. In 1956, he emigrated to USA and later naturalized as a citizen.

CORMACK, ALLAN M.
USA

In 1963, he wrote a paper describing the mathematical basis for the construction of a Computerized Axial Tomograph (CAT), but hardly ever anybody took notice of it. It was in 1970 he came to know that Hounsfield of the British firm of EMI built a CAT scanner on a concept similar to his. The device has now become an indispensable tool in non-invasive diagnosis of various human diseases ranging from brain tumours to other lesions of internal organs.

◆

For the development of computer assisted tomography.

Hounsfield, Sir Godfrey N., b.—August 28, 1919, Newark, England. An engineer with the EMI company in the United Kingdom. He was brought up on a farm in the UK. He used to overcome his boredom in the farm life by thinking how things work and then learning them, and this is how he became inventive.

HOUNSFIELD, Sir GODFREY N.
Great Britain

Before joining the EMI in 1951, he had worked on radar and solid state computers. While working on the above he hit upon the future idea and design of a Computerised Axial Tomograph (CAT) and made a working model of the same between 1969 and 1972. In 1974, the actual scanner for the whole human body came into being. He received the prize along with Allan Cormack, who also independently developed the mathematical basis of an axial tomograph.

Note: The 1979 prize was awarded jointly to Hounsfield and Cormack.

Literature

For his poetry, which, against the background of Greek tradition, depicts with sensuous strength and intellectual clearsightedness modern man's struggle for freedom and creativeness.

Elytis, Odysseus, b.—November 2, 1911, Iraklion, Crete. After his primary schooling, he entered the Law School of the University of Athens but left it without taking any degree.

ELYTIS, ODYSSEUS pen name of
ALEPOUDHELIS, ODYSSEUS
Greece

After hearing some lectures by Andreas Embricos in 1935, he experimented with writing and making fantastic collages. He exhibited some of his collages in the International Surrealist Exhibition in Athens in 1935. He published a group of poems called the *First Poems*, subsequently he published another group called *Orientations* (1936). In later years, he published *Hourglass of the Unknown* (1937), *In Service of Summer* and *Sun the first, together with Variation on Sunbeam* (1943). He published a book of songs entitled, *The Ro Eros* (1972), a book of art criticism, *The Painter Theophilos* (1973) and a collection of essays, *Open Book* (1974). During the Nazi occupation of Greece, he joined the anti-Fascist resistance to the Italians in Albania. After the war he remained practically silent till he published *To Axion Esti* in 1959.

Peace

Mother Teresa, b.—August 10, 1910, Skopje, Yugoslavia. Her family is from an Albanian peasant stock. She attended the local government school (*Gimnaziya*), where she became a member of the sodality. At that time, the Jugoslav Jesuits had accepted to work in Calcutta Archdiocese. The first group arrived in Calcutta on December 30, 1925. Young Teresa was one of the Sodalists who volunteered for the Bengal mission. She was put in touch with Loreto nuns in Ireland, as they were working in the Calcutta Archdiocese.

On November 28, 1928, she was sent to Loreto Abbey, Rathfarnham near Dublin, Ireland, and from there to India to begin her noviciate in Darjeeling. From 1929 to 1948 she taught geography at the St. Mary's High School in Calcutta and for some years she was the Principal of the School. She was also in charge of the Daughters of St. Anne, the Indian religious order attached to the Loreto sisters.

MOTHER TERESA
India

On September 10, 1946 she asked permission from her superior to live alone outside the cloister and to work in Calcutta slums. Her request was taken to Rome and approved. On August 8, 1948 she laid aside the Loreto habit and clothed herself in simple white *sari* with blue border and a cross on the shoulder. She went to Patna for three months to the American Medical Missionary Sisters for an intensive nursing training. She came back to Calcutta and started living with the Little Sisters of the poor. On October 7, 1950 the new congregation of the Missionaries of Charity (M.C.) was approved and instituted in Calcutta and from there spread throughout India. In 1962, she became a citizen of India by naturalization. She works for the poor and the downtrodden and is a vehement opponent of population control by abortion.

Her *Nirmala Sishu Bhaban* (orphanage) houses hundreds of unwanted and abandoned children. She tries to find homes for them and never resorts to any conversion of religious faiths. Her *Nirmal Hriday* and *Prem Dan* give shelter to dying persons who are left neglected on roadsides. She has also opened a number of homes for the lepers all over the world, for their treatment and rehabilitation. She has lately opened a home for AIDS victims in USA.

On February 1, 1965 the Missionaries of Charity became a society of pontifical rights. Its branches were opened in Venezuela, Sri Lanka, Tanzania, Australia, Italy, Jordan, Austria, Germany, Pakistan, Bangladesh, etc. For her work she received the following awards:

Magsaysay Award (1962), Pope John XXIII Peace Prize (1971), Good Samaritan Award (1971), John F. Kennedy International Award (1971), Jawaharlal Nehru Award (1972), Templeton Award (1972), *Mater et Magistra* Award of the IIIrd order of St. Francis of Assisi (1974).

Economic Sciences

For their pioneering research into economic development with particular consideration of the problems of developing countries.

Schultz, Theodore W., b.—April 30, 1902, Arlington, South Dakota. He graduated from the South Dakota State College and later studied at the University of Wisconsin, receiving his Ph.D. in 1930. He taught agricultural economics at the Iowa State University from 1930 to 1943. He resigned in 1943. He then joined the University of Chicago and worked as the Chairman of the Chicago University's department of economics from 1946 to 1972. After World War II he was intrigued with the rapid economic recovery of vanquished Germany. He devoted his efforts to study the situation and defined how human resources influenced overall economic development. He systematized how investments in education can affect productivity in agriculture as well as the economy as a whole. He argued that farmers in developing countries were efficient in the use of available resources and would quickly adopt new methods of production if given a chance to do so. He was the co-recipient of the prize with Sir Arthur Lewis. His principal publications are: *Agriculture in an Unstable Economy* (1945), *The Economic Value of Education* (1963) and *Transforming Traditional Agriculture* (1964).

SCHULTZ, THEODORE W
USA

◆

For their pioneering research into economic development with particular consideration of the problems of developing countries.

Lewis, Sir Arthur, b.—January 23, 1915. St.

LEWIS, Sir ARTHUR
Great Britain

Lucia, British West Indies. A black economist who went to England in his teens. He received his university education at the London School of Economics and Manchester University and earned a doctorate from the London School of Economics in 1940. He was a lecturer at the University of London during 1938-48 and taught at the University of Manchester from 1948 to 1959, holding professorship for a number of years. He became principal of the University College of the West Indies in 1959 and then held the post of Vice-Chancellor of the University of West Indies until 1963. He was knighted by the British Queen for his services in the field of education. In 1963, he moved to Princeton University as professor of public and international affairs. He served as an adviser to the government of many developing countries, and to the United Nations.

His major published works include: *Overhead Costs* (1949), *The Principles of Economic Planning* (1949), *The Theory of Economic Growth* (1955) and *Growth and Fluctuation* (1978).

Note: The 1979 prize in Economic Sciences was awarded jointly to Schultz and Lewis.

1980

PHYSICS

Cronin, James W. / Fitch, Val L.

CHEMISTRY

Berg, Paul / Gilbert, Walter
Sanger, Frederick

PHYSIOLOGY OR MEDICINE

Benacerraf, Baruj / Dausset, Jean
Snell, George D.

LITERATURE

Milosz, Czeslaw

PEACE

Perez Esquivel, Adolfo

ECONOMIC SCIENCES

Klein, Lawrence R.

Physics

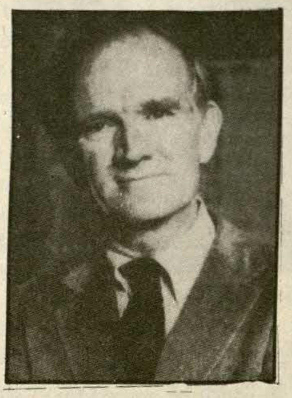
For the discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons.

Cronin, James W., b.—September 29, 1931, Chicago, Illinois. An American physicist, Cronin was educated at the Southern Methodist University and at Chicago, where he obtained his Ph.D. in 1955. After a period at the Brookhaven National Laboratory he moved to Princeton in 1958 and later served as professor of physics from 1965 until 1971 when he was appointed to a chair at the University of Chicago. In 1956 Tsung Dao Lee and Chen Ning Yang made the startling claim that parity (P) was not conserved in weak interactions. To the surprise of physicists their bold conjecture was confirmed in a matter of months. It was however widely assumed that in a reaction the combination of parity and a property called charge conjugation (C) was conserved. Cronin and Val Fitch, together with James Christenson and Rene Turlay, tested this CP conservation in 1964 by investigating the decay of neutral kaons. It was known that one type of kaon could decay into two pions; the other could not without violating CP conservation. Cronin and his colleagues discovered a small number of decays of the second type into two pions, clearly demonstrating that CP is violated. The result is of fundamental interest for it is known that the combined properties of charge conjugation (C) parity (P) and time (T) are conserved so that if CP is violated then the decay of the kaons is not symmetrical with respect to time reversal. Cronin and Fitch shared the prize for this work. ◆

CRONIN, JAMES W.
USA

For the discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons.

Fitch, Val L., b.—March 10, 1923. Marriman, Nebraska. A physicist at the Princeton University. He shared the prize with Cronin of the University of Chicago. They worked together in the Brookhaven National Laboratory and found the two



FITCH, VAL L.
USA

key laws of symmetry: (1) In nuclear reactions all particles can be replaced by their antimatter opposites, e.g. electron by positrons, (2) Nature does not distinguish between a reaction and its minor image with respect to such processes as the decay of particles. Experimenting with shortlived particles as neutral K2 mesons, they found that in 2 of every 1000 reactions these bits of matter would decay into a pair of JJ mesons (Pions) instead of the three pions as predicted on the basis of existing rules on symmetry.

Note: The 1980 prize for Physics was awarded jointly of Cronin and Fitch.

Chemistry

For his fundamental studies of the biochemistry of nucleic acids, with particular regard to recombinant-DNA.

Berg, Paul, b.—June 30, 1926, New York City. An American molecular biologist. He was educated at Pennsylvania State University and Western Reserve University where he obtained his Ph.D. in 1952. He taught first at the School of Medicine at Washington University, St. Louis, moving to the University of Stanford in California in 1959, where he became professor of biochemistry in 1960

BERG, PAUL
USA

In 1955 Francis Crick proposed his adaptor hypothesis, in which he argued that amino acids did not interact directly with the RNA template but were brought together by an adaptor molecule. Crick offered little information on the nature of such molecules, merely arguing that they might well be a specific adaptor for each of the 20 amino acids. In 1956 Berg successfully identified such an adaptor, later known as transfer RNA, even though he was then unaware of Crick's hypothesis. He found a small RNA molecule that appeared to be quite specific to the amino acid methionine.

Berg's name later became known to a much wider public with the publication in *Science* (July 24, 1974) of the "Berg letter" written with the backing of many leading molecular biologists, in which he gave clear warning of the dangers inherent in the uncontrolled practice of recombinant DNA experiments. It had become possible, Berg stated, to excise portions of DNA from one organism using specialized enzymes, and to insert them into the DNA of another organism. For example, the harmless microorganism Escherichia coli, found in all laboratories, could be implanted with active DNA from the tumour-causing virus SV 40 and perhaps allowed to spread throughout a human population with quite unpredictable results. Berg consequently proposed an absolute voluntary moratorium on certain types of experiment and strict control on a large number of others. An international conference was held in Asilomar, California, followed by the publication of strict guidelines by the National Institutes of Health in 1976. That such agreement could be reached and maintained, it has been claimed, was largely a result of the integrity and authority of Berg. Ironically Berg was awarded the prize for the part he played in developing the splicing techniques that made recombinant DNA techniques possible in the first place.

◆

For their contributions concerning the determination of base sequences in nucleic acids.

Gilbert, Walter, b.—1932. A biological chemist at the Harvard University who along with Sanger of the Cambridge University vastly advanced the new technology of recombinant DNA, with their different methods for determining the sequence of nucleotides which carry the message in the longchained DNA molecules. His method is essentially chemical and it uses reagents to test for

GILBERT, WALTER
USA

different neucleotides among the molecules. He shared the prize along with Frederick Sanger and Paul Berg.

◆

For their contributions concerning the determination of base sequences in nucleic acids.

Sanger, Frederick. Twice recipient of the Nobel Prize in Chemistry (1958).

SANGER, FREDERICK
Great Britain

Note: The 1980 prize was divided, one-half being awarded to Berg and the other half jointly to Gilbert and Sanger.

Physiology or Medicine

For their discoveries concerning genetically determined structures on the cell surface that regulate immunological reactions.

Benacerraf, Baruj, b.—October 29, 1920, Caracas, Venezuela. An American immunologist, Benacerraf was brought up in France but moved to America in 1940, becoming naturalized in 1943. He studied at Columbia and the University of Virginia where he obtained his MD in 1945. He worked first at the Columbia Medical School before spending the period 1950-56 at the Hospital Broussais in Paris. He returned to America in 1956 to the New York Medical School where he served from 1960 to 1968 as professor of pathology.

BENACERRAF, BARUJ
USA

After a short period at the National Institute of Allergy and Infectious Diseases at Bathesda, Maryland, Banacerraf accepted the chair of comparative pathology at Harvard in 1970. In the 1960s working with guinea pigs, Benacerraf began to reveal some of the complex activity of H2 system described by George Snell. In particular he identified the Ir (immune response) genes of the H2 segment as playing a crucial role in the immune system. This was achieved by injecting simple, synthetic and controllable antigens into his experimental animals and noting that some strains responded immunologically while others were quite tolerant. Such differential responses have so far indicated there are over 30 Ir genes in the H2 complex.

Later work began to show how virtually all responses of the immune system, whether to grafts, tumour cells, bacteria or viruses, are under the control of the H2 region. Benacerraf and his colleagues continued to explore its genetic and immunologic properties and also to extend their work to the analagous HLA system in humans.

This work may well be important in the study of certain diseases, such as multiple sclerosis and ankylosing spondylitis, which have been shown to entail defective immune responses. ◆

For their discoveries concerning genetically determined structures on the cell surface that regulate immunological reactions.

Dausset, Jean, b.—October 19, 1916, Toulouse. He is the son of a doctor. At present he is a scientist at the Saint-Louis Hospital, University of Paris, France. He found by comparing the white blood corpuscles of patients undergoing blood transfusion with the same of the donors that, distinct antigens were present on the cell surfaces. He then located the controlling genes. As these antigens were found in white blood cells those are called *Human Leukocyte Antigens* (HLA), even though they exist in all tissues.

DAUSSET, JEAN
France

His discoveries as well as those of Snell's have led to better matching of donor organs with recipients. The HLA typing has become a major test in forensic diagnosis. It has helped to identify rapists from semen stains and in one case of paternity suit it showed that a pair of fraternal twins were sired by two different men. Through HLA typing, it may be possible to tell an individual what illnesses he is most likely to contact in future. ◆

For their discoveries concerning genetically determined structures on the cell surface that regulate immunological reactions.

Snell, George D., b.—December 19, 1903, Bradford, Massachusetts. A retired scientist at the Jackson Laboratory, Bar Harbour, Maine, USA. He worked independently to study a group of genes that are intimately linked to the body's immune response. Attempting to transplant tumour cells and then normal tissue, he discovered that the success of the operation depended on the protein molecules on the surface of the cells. These proteins, which are called the antigens, have characteristic shapes and structures, but their combinations vary from individual to individual. He found that the more antigen the subjects had in common, the more likely was the graft to take. Investigating further he learnt that the formation of antigens was controlled by a group of genes on a specific chromosome in nucleus of cells. He called these genes *Major histocompatibility complex* since it was the prime factor in determining whether the transplanted tissue would be rejected.

SNELL, GEORGE D.
USA

Note: The 1980 prize was awarded jointly to Benacerraf, Dausset and Snell.

Literature

Who with uncompromising clear-sightedness voices man's exposed condition in a world of severe conflicts.

Milosz, Czeslaw, b.—June 30, 1911, Lithuania.

A Lithunanian born Polish poet and a lecturer in the Slavic language department of the Berkeley University, California, USA.

MILOSZ, CZESLAW
USA

He made his debut as a poet in a university magazine and later helped to form a literary group called *Zagary* (the torch). The group played a significant part in the politically radical Polish *avant garde* movement which was called the "catastrophic school." His first collection of poems appeared in 1933, which fetched him a prize and enabled him to study in Paris during 1934-35. He published his second collection of poems *The Three Winters* in 1936. The post-war years found him a national hero and author of *Ocalenic* (Rescue), one of the first books of poems to be published in Communist Poland. From 1946 to 1950, he served in Washington and Paris as a member of Polish diplomatic corps. He has translated T.S. Eliot, Walt Whitman, and Carl Sandberg. In 1951, he was an exile in Paris, where he worked for a Polish language publishing house. The precise reasons for his exile became very clear with the publication of *The Captive Mind*, a psychological analysis of intellectuals and artists under Communism. In 1960, he joined the faculty of the University of California at Berkeley.

He is a versatile linguist, he knows English, Russian, French, Greek and Hebrew. He learnt Hebrew in order to translate the *Book of Psalms* in Polish. His *Selected Poems* and *Bells in Winter* have earned glowing tributes from writers and poets all over the world.

Peace

Perez Esquivel, Adolfo, b.—1932, Buenos Aires, Argentina. A former professor of art and art-history. He was twice previously nominated for the peace prize. He gave up his profession to devote all his time and energy to the work of co-ordinating the activities of the various non-violent organizations throughout Latin America. He is a devout Roman Catholic and founder and head of Argentina's *Servicio Paz y Justicia* (Peace & Justice Service). The group is dedicated to human rights, giving both spiritual and moral support and practical aid for poor and oppressed people.

PEREZ ESQUIVEL, ADOLFO
Argentina

He is a moral disciple of Mahatma Gandhi. He formed groups dedicated to non-violent social changes. The military government of Argentina disliked his activities, so he was arrested, tortured and jailed for 14 months without any specific charges. He is the second Argentinian to get the prize for peace, the first was Senor Saavedra Lamas who received the prize in 1936. By virtue of a prevailing Argentine law as a Nobel Laureate he will be entitled to a salary of 5000 US dollars per month besides the prize money, even though the ruling junta dislikes him.

He accepted the prize on behalf of the people of Latin America, emulating the example of Mother Teresa of India. He proposes to spend the money for the poors, South American Indians, peasants and workers in Latin America. In 1981, the Argentine government declined to give him 5000 US dollars a month pension on the plea that Senor Esquivel is non-resident in his country for most of the year.

Economic Sciences

KLEIN, LAWRENCE R.
USA

For the creation of econometric models and their application to the analysis of economic fluctuations and economic policies.

Klein, Lawrence R., b.—1920. He graduated from the University of California with highest honours in economics. He received his Ph.D. in economics from the Massachusetts Institute of Technology in 1944 under Professor Samuelson and then joined the Cowles Commission for Research in Economics. Subsequently, he taught at the University of Michigan during 1949-54. Since 1958 he has been working as professor of economics and finance at the Wharton School of Finance, University of Pennsylvania. He is a pioneer in the development of a large econometric model of the United States and of LINK—a technique to integrate econometric models of different countries.

His major works are: *The Keynesian Revolution* (1947), *Text Book of Econometrics* (1953), *An Econometric Model of the United States, 1929-52* (1955), *Readings in Business Cycles* (1965) (ed. with R.A. Gordon), *Wharton Econometric Forecasting Model* (1957).

1981

PHYSICS

Siegbahn, Kai M. / Bloembergen, Nicolaas
Schawlow, Arthur L.

CHEMISTRY

Fukui, Kenichi / Hoffmann, Roald

PHYSIOLOGY OR MEDICINE

Sperry, Roger W. / Hubel, David H.
Wiesel, Torsten N.

LITERATURE

Canetti, Elias

PEACE

Office of the United Nations
High Commissioner for Refugees

ECONOMIC SCIENCES

Tobin, James

1981

Physics

For his contribution to the development of high-resolution electron spectroscopy.

Siegbahn, Kai M., b.—April 20, 1918, Lund, Sweden, Swedish physicist. Siegbahn was the professor of physics at the Royal Institute of Technology, Stockholm from 1951 to 1954. He has been at the University of Uppsala since 1954. Here he worked on the emission of electrons from substances irradiated with X-rays. Siegbahn's technique is to subject a specimen to a narrow beam of X-rays with a single wavelength (i.e. energy) and measure the energy spectrum of the ejected electrons by magnetic or electrostatic deflection. The spectrum shows characteristic peaks formed by electrons ejected from different inner energy levels of atoms. Moreover, the positions of these peaks depend to a slight extent on the way in which the atom is linked to other atoms in the molecule. These "chemical shifts" allow the technique to be used as an analytical tool—Siegbahn has named it ESCA (electron spectroscopy for chemical analysis). He has also worked on the related technique of ultraviolet photoelectron spectroscopy developed by David Turner. Siegbahn is the son of Karl Manne Siegbahn who won the Nobel Physics Prize in 1924.

SIEGBAHN, KAI M.
Sweden

◆

For their contribution to the development of laser spectroscopy.

Bloembergen, Nicolaas, b.—March 11, 1920, Dordrecht, The Netherlands. An American physicist. Bloembergen was educated at the universities of Utrecht and Leiden, where he obtained his Ph.D. in 1948. He moved to America soon afterward, joined the Harvard staff in 1949, and has served since 1957 as Gordon McKay Professor of Applied Physics and since 1974 also as Rumford Professor of Physics. In the mid-1950s Bloembergen introduced a simple yet effective modification to the design of the maser. First built by Charles Townes in 1953, the early maser could only work intermittently once the electrons in the higher energy level had been stimulated they would fall down to the

BLOEMBERGEN, NICOLAAS
The Netherlands/USA

lower energy level and nothing further could happen until they had been raised to the higher level once more. Bloembergen developed the three level and multilevel masers, which were also worked on by Nikolai Basov and Aleksandr Prokhorov in the Soviet Union. In the three-level maser, electrons are pumped to the highest level and stimulated. They consequently emit microwave radiation and fall down to the middle level where they can once more be stimulated and emit energy of a lower frequency. At the same time more electrons are being pumped from the lowest to the highest level making the process continuous. Bloembergen has worked extensively on nonlinear optics, i.e. on effects produced by high intensities of radiation. He has particularly investigated the use of lasers to excite or break particular bonds in a chemical reaction.

Bloembergen wrote *Nuclear Magnetic Relaxations* (1948) and *Nonlinear Optics* (1965). ◇

For their contribution to the development of laser spectroscopy.

Schawlow, Arthur L., b.—1921, Mount Vernon, New York. He studied at the University of Toronto, Canada, and has been a Professor of Physics at the Stanford University. In 1958, while he was still a research worker at the Bell Laboratories he overcame the difficulties of conventional spectroscopy. Along with his Nobel Laureate brother-in-law Charles H. Townes (1964, Physics), he devised a way to build a practical laser, a device for creating narrow, intense single frequency beams of so-called coherent light. One of Schawlow's notable fits was studying the simplest of all elements, hydrogen with hitherto unattainable precision. He extended the exploratory range of lasers far beyond the realm of visible light by mixing three beams to produce a fourth one of exceptionally long or short wave length.

SCHAWLOW, ARTHUR L.
USA

Note: The 1981 prize was divided, one-half being awarded to Siegbahn and the other half jointly to Bloembergen and Schawlow.

Chemistry

For their theories developed independently, concerning the course of chemical reactions.

Fukui, Kenichi, b.—October 4, 1918, Nara, Japan. The first Japanese to win a Nobel prize in chemistry. He graduated from the Kyoto University in 1941 and also received his doctorate from the same institution. He was appointed a professor of chemistry in 1951. He researched in determining why some chemical reactions between atoms and molecules can occur and others cannot. He developed a theory of "frontier orbitals" showing that orbits of the most loosely bound, or outermost electrons play an unexpectedly large role in the reactivity of molecules. He was first brushed off by the Japanese chemists but was later proved right. ◇

FUKUI, KENICHI
Japan

For their theories, developed independently concerning the course of chemical reactions.

Hoffmann, Roald, b.—July 18, 1937, Zloczow, Poland. He came to the United States of America at the age of only 11 years after a harrowing childhood in Nazi-occupied Poland. He graduated from the Columbia University in 1958 and earned his Ph.D. in chemistry from the Harvard University. He has been associated with the Cornell University since 1965. He became a naturalized American in 1955.

HOFFMANN, ROALD
USA

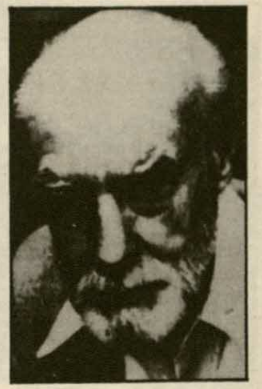
He independently reached a conclusion which is similar to Fukui's, that a reaction is more likely to occur if molecules or atoms are likely to have the same orbital properties after they join as they had before. In other words, nature wants to conserve what scientists call orbital symmetry. His work and that of Fukui's aim at theoretically anticipating the course of chemical reactions. Their work is based on quantum mechanics, which attempts to explain how atoms behave.

Note: The 1981 prize was awarded jointly to Fukui and Hoffmann.

Physiology or Medicine

For his discoveries concerning the functional specialization of the cerebral hemispheres.

Sperry, Roger W., b.—August 20, 1913, Hartford, Connecticut. He is attached to the California Institute of Technology as a Professor of Behavioral Science. He carried on his prize winning research work for over three decades. It forms the theoretical basis of the modern research into how the brain processes information. Previously, it was thought that one half of the cerebrum was dominant (in right handed subjects the left one and the *vice versa*) and the other was a minor one having very little capacity for psychic functions.



SPERRY, ROGER W.
USA

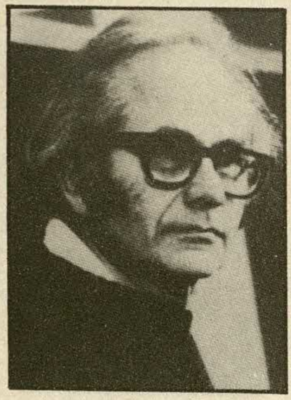
Working first with animals, Sperry severed the millions of nerve fibres connecting the two halves of the cerebrum. He discovered that the animals still could perform learned tasks when stimulated unilaterally. But the other hemisphere could be taught to perform similar tasks, thus demonstrating that, each hemisphere possessed independent ability to learn. He made studies on epileptic humans who had undergone cerebral ablative surgery for control of seizures and found that they suffered no changes in psychic capacity. He proved that each hemisphere in such patients had its own domain of consciousness, perceptive experience, emotions, thoughts and memory. *According to him the concept of dominance of any particular half of cerebrum is no longer tenable.*

◆

For their discoveries concerning information processing in the visual system.

Hubel, David H., b.—1926. Windsor, Ontario, Canada. He is a Professor at the Harvard Medical School.

Hubel and Wiesel are pioneers in showing how man thinks and processes informations, from his environment through his eyes. They demonstrated the existence of a decoding system from the retina to the brain that provides a new model for understanding the brain. *They proved that the brain is not a computer which would make cybernetics a dead science.* It has its own special characteristics and we can now begin to build new experimental model of the brain. They found by measuring electrical impulses given off by the neurons of the visual cortex, that the cells in the cortex are arranged in regular columnar pattern organized into equally regular "hypercolumns". They also found that each cell within each column has specific responsibility to perceive and analyse incoming images according to contrast, linear patterns and movements on the retina. Within the columns the analysis also occurs in a formal sequence. Eventually, all those informations are relayed to the higher centres where the visual impression is assembled and its memory is stored.



HUBEL, DAVID H.
USA

◆

For their discoveries concerning information processing in the visual system.

Wiesel, Torsten N., b.—1924, in Uppsala, Sweden. A Swedish physiologist who worked with David Hubel at the Harvard University Medical School in Cambridge, USA. They together found out that psychology teaches that the sense elements adapt to light. This adaptation is not only a function of the rods and cones of the retinae themselves, but of the first layer of neurones which they connect. Adaptation, in more general terms, means the following according to both of them. A single rod or cone adjusts its sensitivity according to the steady flux on it and on its neighbours. Any change it reports is normalized to the temporal and spatial averages of the light in the neighbourhood. Such an automatic gain control ensures that, for the most part, only representations of change are available for later processing. So, the age old theory of Helmholtz is further substantiated, who stated that, man is blind if nothing alters in the retinal image. According to Hubel and Wiesel, each patch of primary visual cortex is supplied by both retinae. Some cells respond to one eye, some to the other. But in some, the processing in the receptive field depends on local detail in corresponding parts of both retinae, so that registration of the eyes with respect to the visual fields can be told from the cells response. Thus they uncovered a subtler notion than that of simple spatial processing which was already in their heritage. And that is why their work is concerned with binocular interaction of cerebral cortex.

WIESEL, TORSTEN N.
Sweden

Note: The 1981 prize was divided, one-half being awarded to Sperry and the other half jointly to Hubel and Wiesel.

Literature

For writings marked by a broad outlook, a wealth of ideas and artistic power.

Canetti, Elias, b.—July 25, 1905, Rustchuk, Romania. His parents moved to England in 1911 and after his father's death in 1913, the family moved to Vienna.

At Vienna, Canetti became a close friend of Franz Kafka. He published a book about Kafka entitled *Der Andere Prozess* (Kafka's other Trial, 1969). In 1938, after the Nazi *anschluss* of Austria, Canetti fled to France and ultimately settled in London. His first important political work, *Masse Und Macht* (Crowds and Power) appeared in 1969. It is a sweeping survey of human mass behaviour.

CANETTI, ELIAS
Great Britain

Canetti is a pacifist and anti-fascist. His memoirs reflect hate for all wars and totalitarian thoughts. He was awarded the prize specially for his novel *Die Blendung* which deals with totalitarian psychology. It was published in USA in 1947 under the title *The Tower of Babel.*

Peace

OFFICE OF THE UNITED NATIONS HIGH COMMISSIONER FOR REFUGEES
Geneva, Switzerland

The Office of the United Nations High Commissioner for Refugees won the prize for helping the enormous growing number of refugees around the world.

It was the fourth peace prize for the office or its predecessors. The United Nations High Commissioner's office won the prize in 1954 for resettling the European refugees after World War II. The Nansen International office a forerunner of this year's laureate organisation won the prize in 1938. Fridtjof Nansen, the Norwegian arctic explorer and humanist after whom the Nansen office was named, won the prize in 1922. It was the 14th time that the peace prize went to an organization. The International Red Cross has won the prize thrice, in 1917, 1944 and 1963.

Economic Sciences

For his analyses of financial markets and their relations to expenditure decisions, employment, production and prices.

TOBIN, JAMES
USA

Tobin, James, b.—March 5, 1918, Champaign, Illinois. He graduated from Harvard University in 1939 and received his doctorate there in 1947. He was associate professor of economics at Yale University since 1955. He was a member of the President's Council of Economic Advisors during 1961-62 and was director of the Cowles Foundation for Economic Research during 1955-61 and 1964-65. He has been the recipient of honorary doctorates from a number of universities. A leading exponent of the Keynesian school, Tobin is famous for his portfolio selection model of liquidity preference in which he postulated that an individual asset holder has a portfolio of money and bonds. Money neither brings any return nor imposes any risk. Bonds yield interest and also bring income. But income from bonds is uncertain because it involves a risk of capital loss or gain.

Individuals, desiring both high yield and low risk, must make a trade-off in deciding about their portfolio assets.

His major publications include *The American Business Greed* (1956), *National Economic Policy* (1966), *Essays in Economics*; Vol. 1: *Macroeconomics* (1971), Vol. 2: *Consumption and Econometrics* (1975), Vol. 3: *Theory and Policy* (1982) and *Reflections on Contemporary Macroeconomic Theory* (1980).

1982

PHYSICS

Wilson, Kenneth Geddes

CHEMISTRY

Klug, Aaron

PHYSIOLOGY OR MEDICINE

Bergström, Sune K. / Samuelsson, Bengt
Vane, Sir John R.

LITERATURE

Garcia Marquez, Gabriel

PEACE

Myrdal, Alva / Garcia Robles, Alfonso

ECONOMIC SCIENCES

Stigler, George J.

1982

Physics

For his theory for critical phenomena in connection with phase transitions.

Wilson, Kenneth Geddes, b.—June 8, 1936, Waltham, Massachusetts. The eldest son of Edger Bright Wilson, Jr., a well-known physicist with specialized interest in microwave spectroscopy. He taught at Harvard and was awarded the National Medal of Science.

WILSON, KENNETH GEDDES
USA

Kenneth was interested in science since early childhood, and once told a reporter that he used to spend the time waiting for his school bus in figuring out cube roots. After graduating from the George School in Bucks county, Pennsylvania, he enrolled at Harvard College in 1952 and obtained his B.A. in 1956. He embarked on graduate work in physics at the CALTEC from 1956 to 1960 under the guidance of the Nobel Laureate physicist Murray Gell-Mann who developed the theory of sub-atomic particles called 'quarks'. In 1961 Wilson obtained his Ph.D. from the CALTEC. He then became a Junior Fellow at Harvard. Since 1962 he has been on the faculty of the Cornell University. His doctoral thesis, *Investigation of the Low Equation and the Chew-Mandelstam equations*, was in the area of quantum field theory.

He has been awarded many prizes. The Nobel prize was awarded to him specifically for the phase transition work, but seldom in recent years has the award been more justified in terms of total influence in the world of theoretical and experimental physics and chemistry.

Chemistry

For his development of crystallographic electron microscopy and his structural elucidation of biologically important nucleic acid-protein complexes.

Klug, Aaron, b.—August 11, 1926, Lithuania. He grew up in South Africa. He began his scientific career in physics which he still teaches to the undergraduates at the Peterhouse College, Cam-

KLUG, AARON
Great Britain

bridge. His doctoral work at Cambridge involved the determination of what happens to molten steel when it crystallizes into a solid.

He later turned his attention to biological systems, including the oxygen carrying molecule haemoglobin, and the structure of viruses. One of his major achievements was the development of new techniques in electron microscopy. His most recent work was on the structure of neucleosomes. He won the prize for his development of crystallographic electron microscopy and his structural elucidation of biologically important nucleic acid-protein complexes.

Physiology or Medicine

For their discoveries concerning prostaglandins and related biologically active substances.

Bergstrom, Sune K., b.—January 10, 1916, Stockholm, Sweden. He is recognized for his pioneering work on the isolation of the prostaglandins and the elucidation of their structures. Knowledge of the structures of the prostaglandins provided the key that widened this field of research.

BERGSTROM, SUNE K.
Sweden

Bergström, previously Professor and Chairman of Chemistry and later Rector of the Karolinska Institute in Stockholm, is now Chairman of the WHO Advisory Committee on Medical Research.

The prize was awarded to Sune Bergstrom, Bengt Samuelsson both of Sweden, and John Vane of England, for their discoveries concerning prostaglandins and related biologically active substances. This group of compounds includes prostaglandin (PG) E_2, PGF_2a, PGD_2, thromboxane A_2 prostacyclin, and the leukotrienes. All are potent chemical transmitters of intercellular and intracellur signals that mediate a diversity of physiological and pathological functions. They all are formed from oxygenation of arachidonic acid, a 20-carbon polyunsaturated fatty acid.

◆

For their discoveries concerning prostaglandins and related biologically active substances.

Samuelsson, Bengt, b.—May 21, 1934, Halmstadt, Sweden. He was honored for his research elucidating the mechanisms of the biosynthesis of the prostaglandins and the pathways of their metabolism. His incisive studies on the oxygenation of arachidonic acid led to the discovery of the labile intermediates in prostaglandin formation, the cyclic endoperoxides PGG_2 and PGH_2. The isolation and identification of these intermediates provided the basis for the discovery by him of thromboxane A_2, and for progress in many other areas, Samuelsson's work also has elucidated the biosynthesis and structures of leukotrienes.

SAMUELSSON, BENGT
Sweden

Bengt Samuelsson is Professor and Chairman of Chemistry as well as Dean of the Karolinska Institute.

◆

For their discoveries concerning prostaglandins and related biologically active substances.

Vane, Sir John R., b.—March 29, 1927, Worcestershire, England. He is recognized for the discovery that, vascular endothelium produces the potent inhibitor of platelet aggregation, prostacyclin. Earlier, he also demonstrated that arachidonic acid is converted by guinea pig lung to labile vasoconstrictors which subsequently were found by Bengt Samuelsson to consist largely of thromboxane A_2. John Vane discovered that aspirin blocked that formation of these arachidonic acid derived vasoconstrictors and subsequently demonstrated that aspirin and related nonsteroidal antiinflammatory drugs block the enzymatic conversion of arachidonic acid to the prostaglandins. John Vane is Group Research and Development Director of the Wellcome Foundation in Beckenham, England.

VANE, Sir JOHN R.
Great Britain

Note: The 1982 prize was awarded jointly to Bergström, Samuelsson and Vane.

Literature

For his novels and short stories, in which the fantastic and the realistic are combined in a richly composed world of imagination, reflecting a continent's life and conflicts.

Garcia Marquez, Gabriel, b.—1928, Aracataca. One of 16 children of a poor telegraph operator, he spent his first eight years with his maternal grandparents. His grandfather seems to have suggested the principal character of *No One Writes to the Colonel*. His grandmother nourished young Gabriel on stories of ghosts and dialogues with spirits.

GARCIA MARQUEZ, GABRIEL
Colombia

Marquez has produced a series of enduring and popular works, including *Leaf Storm* (1955), *In Evil Hour* (1962), *Big Mama's Funeral* (1962), *One Hundred Years of Solitude* (1967) and *The Autumn of the Patriarch* (1975).

Peace

Myrdal, Alva, b.—January 31, 1902 in Sweden, d.—February 2, 1986, Stockholm. She grew up in a middle class socially conscious family. She had a long career as a teacher and a director of Teachers Colleges in Sweden before she became

MYRDAL, ALVA
Sweden

head of the United Nations' Department of Social Welfare in 1949. In 1950 she became director of the Department of Social Studies of the United Nations Educational, Scientific and Cultural Organization. In 1955 she was appointed Ambassador to India, a move that left the Swedish business community aghast. She was widely distrusted in non-socialist circles as too radical in her views and too impractical. She soon achieved a special rapport with Prime Minister Jawaharlal Nehru and Indians at all levels. In a short time she was sending back detailed reports that indicated a firm grasp of the situation there. Swedish business leaders then expressed delight with her embassy's efficiency in matters of trade.

In 1961 Mrs. Myrdal was asked to become special assistant on disarmament to the Swedish Foreign Minister. In 1962 she began her political career as a Member of Parliament from the ruling Social Democratic Party. In 1966 she was named to the Swedish Cabinet as minister in charge of disarmament and church affairs. Mrs. Myrdal has been married for over six decades to Gunnar Myrdal, the economist who won a Nobel Prize in economics in 1974. and has at times collaborated with her. One of their major works was *The Crisis in the Population Question* which startled Swedes when it came out in 1934. In this book they warned of the dangers of Sweden's declining birth rate. But they also championed completely voluntary parenthood, sex education and contraceptives, a daring attitude at the time. Mrs. Myrdal, with her husband, shared the West German Peace Prize for 1970. She has also received several different peace awards for her work in disarmament. ◆

GARCIA ROBLES, ALFONSO
Mexico

Garcia Robles, Alfonso, b.—March 20, 1911, Zamora, Mexico. He had his primary and secondary studies in Zamora. He studied law at the National Autonomous University of Mexico and University of Paris, where he graduated in International Law in 1936. He obtained Diploma of the Academy of International Law of The Hague in 1938.

He joined Mexican Foreign Service in 1939, and attained the rank of Ambassador in 1957.

In 1946, he was appointed Director of Political Affairs of the Secretariat of the United Nations, and held this post till March 1957. He was the personal Representative of UN Secretary General in Cairo from November 1956 to January 1957 and Representative of the Secretary General, the Special Political Commission of UN General Assembly, from Third to Eleventh Sessions of UNGA (1948-56).

He became Chairman of the Preliminary Meeting on Denuclearization of Latin America (REUPRAL), Mexico, in November 1965.

He also Chaired the Preparatory Commission for Denuclearization of Latin America (COPREDAL) since its creation till signing of the Tlatellco Treaty in 1967. He had been Mexico's delegate in about 60 International and Interamerican Conferences.

He was the Foreign Minister of Mexico from December 29, 1975 to November 30, 1976. He is the author of over 20 books and about 300 articles on international affairs.

He has received awards from ten countries of Latin America, Asia, Africa and Europe. On October 16, 1981, he was appointed Ambassador Emeritus by the President of the Republic of Mexico.

Note: The 1982 prize was awarded jointly to Alva Myrdal and Garcia Robles.

Economic Sciences

For his seminal studies of industrial structures, functioning of markets and causes and effects of public regulation.

Stigler, George J., b.—January 17, 1911, Renton, Washington. He is the son of a Bavarian immigrant whose various jobs included managing apartment buildings. Stigler graduated from the University of Washington in 1931. Seeing little chance to land on a paying job in the depths of the Great Depression, he decided to try his hand at the graduate school. The fateful decision took him first to Northwestern University in Chicago for a master's degree, and thereafter to the University of Chicago for his Ph.D. in 1938. His first teaching post was an assistant professership at Iowa State University. In 1941, he published his first work, *Production and Distribution Theories*, a survey of late 19th and early 20th century scholarship in the field. Then, a year later, he published *The Theory of Price*, a free market-oriented economics text that is still regularly used in graduate schools around the world.

STIGLER, GEORGE J.
USA

One of Stigler's more widely read and certainly most controversial works, *Roofs or Ceilings, Foundation for Economic Education* (1946), enraged liberals when it was first published. Since then, however, it has become a must reading for economics of all political perspectives and has gained additional popularity as government deregulation of business has grown to be an increasingly important political issue.

1983

PHYSICS

Subrahmanyan, Chandrasekhar

Fowler, William Alfred

CHEMISTRY

Taube, Henry

PHYSIOLOGY OR MEDICINE

McClintock, Barbara

LITERATURE

Golding, William

PEACE

Walesa, Lech

ECONOMIC SCIENCES

Debreu, Gerard

1983

Physics

For his theoretical studies of the physical processes of importance to the structure and evolution of the stars.

Subrahmanyan, Chandrasekhar, b.—October 19, 1910, Lahore, British India (now Pakistan). He belongs to a prominent Hindu family of very high academic standing. His uncle, Sir Chandrasekhar Venkata Raman, was the first Indian to receive a Nobel prize in physics in 1930.

SUBRAHMANYAN, CHANDRASEKHAR
USA

Chandrasekhar was a Fellow of Trinity College, Cambridge, during 1936-37 and professor of physics at the University of Chicago during 1944-46. He has been a member of several learned societies including the American Academy of Arts and Sciences and the Royal Society of London. He has won many medals including the Royal Medal from the Royal Society and Gold Medal from the Royal Astronomical Society. He has published several books—his *The Mathematical Theory of Black Holes* (1983) is considered a seminal work. ◆

For his theoretical and experimental studies of the nuclear reactions of importance in the formation of the chemical elements in the universe.

Fowler, William Alfred, b.—August 9, 1911, Pittsburg, Pennsylvania. Fowler was educated at Lima central high school where he was a versatile footballer and baseballer. He graduated in 1929 with the highest grade. At the Ohio State University he specialized in engineering physics and also obtained the highest grade. To help support himself during his college years he washed dishes in restaurants and worked also as a waiter.

FOWLER, WILLIAM ALFRED
USA

He obtained his bachelor's degree in engineering physics in 1933. He received his Ph.D. in physics in 1936 and then worked in the California Institute of Technology where he became an Assistant Professor in physics. In 1942 he was promoted to the post of Associate Professor. His chief scientific interest lies in the nuclear reactions deep within the fiery interiors of stars.

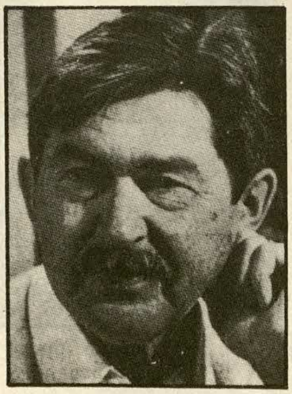
In 1957, he, along with Hoyle, Margaret and Geoffrey Burbidge, explained how the steller furnaces forge progressively heavier atoms out of lighter ones. He also devoted his studies to neutrinos. Despite the difficulty in detecting the neutrinos he deployed ways in which to study them.

Note: The 1983 prize was awarded jointly to Chandrasekhar and Fowler.

Chemistry

For his work on the mechanisms of electron transfer reactions, especially in metal complexes.

Taube, Henry, b.—November 30, 1915, Neudorf, Saskatchewan, Canada. His father was a day labourer. He received B.S. (1935) and M.S. (1937) degrees from the University in Saskatoon. He moved to Berkeley to do his doctoral research (Ph.D. 1940) with W.C. Bray, and he became a US citizen in 1941. He held academic appointments at Cornell during 1941-46; Chicago during 1946-61 and Stanford since 1962 and is now the Marguerite Blake Wilbur Professor of Chemistry at Stanford.



TAUBE, HENRY
USA

Taube has revolutionized the way we think about inorganic redox reactions. He received the prize for his pioneering work on the mechanisms of inorganic oxidation-reduction (redox) reactions.

Physiology or Medicine

For her discovery of mobile genetic elements.

McClintock, Barbara, b.—1902, Hartford, Connecticut. She is the third of four children born to a doctor and his wife. She enrolled at the Cornell University at the age of 17 despite her mother's conviction that college was no place for a woman.

McCLINTOCK, BARBARA
USA

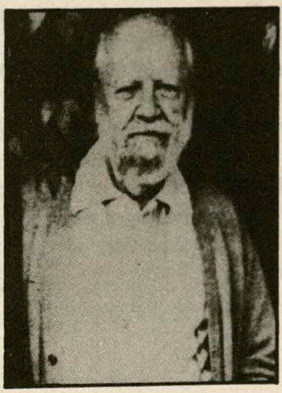
Her intended major subject, plant breeding, was considered unsuitable for ladies, so McClintock settled for botany. She earned a doctorate in plant genetics in 1927 and began a life-long romance with maize. Since tenured faculty positions were not available to women in the thirties, McClintock bounced from job to job. She was unemployed in 1942, when the Carnegie Institution of Washington came to her rescue and offered her a post at its genetics laboratory in Cold Spring Harbor. In 1944 she was elected to the National Academy of Sciences of USA.

Her Nobel Prize research led her to conclude that, genes that govern the colour of a kernel and other such characteristics can be turned on or off by genetic elements that act as switches and that these genetic switches can move from one part of a chromosome to another, as commanded by a third type of element known as an "activator". The Nobel Prize Committee hailed her once obscure work as "one of the two great discoveries of our times in genetics".

Literature

For his novels which, with the perspicuity of realistic narrative art and the diversity and universality of myth, illuminate the human condition in the world of today.

Golding, William, b.—Septemper 19, 1911. His childhood was comfortable but lonely. His parents wanted him to become a scientist, but after two years of science classes at Oxford he switched over to English literature.



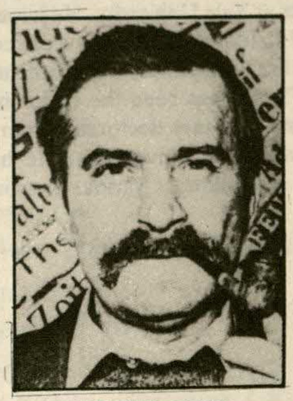
GOLDING, WILLIAM
Great Britain

After graduation he held a succession of odd jobs, including one with a theatre company. He published a volume of poems when he was 23. He joined the Royal Navy during World War II and witnessed the sinking of the German battleship *Bismark*. He also took part in the Normandy invasion. The war gave him an impression that the human race was inherently evil. This was reflected in his best known book *Lord of the Flies* (1954). The novels that followed were *The Inheritors* (1955), *Pincher Martin* (1956), *Free Fall* (1959), *The Spire* (1964), *The Pyramid* (1967), *The Scorpion God* (1971), *Darkness Visible* (1979), *Rites of Passage* (1980), *A Moving Target* (1982) and *The Paper Men* (1984).

He has been honoured with honorary doctorates by many universities including Oxford and Sorbonne.

Peace

Walesa, Lech, b.—1943, Popow, Poland. He is one of the eight children of his parents. After his father died his mother married her brother-in-law Stanisalw Walesa and while visiting her relatives with her husband in the USA in 1973 she was killed in a traffic accident. The stepfather, a lumberman, now lives in New Jersy City. He attended a state vocational school in Lipno near Popow and after graduation moved to Gdansk to work as an electrician at the Lenin shipyard. In December 1970 the raising of the food prices by the Government sparked violent protests in and around Gdansk. During those "bread riots" the strikers at the shipyard moved into the streets, where 50 of them were killed in police firing. In 1976 Walesa was fired from the shipyard for his boldness in protesting against the government policy.



WALESA, LECH
Poland

Two major events in the Polish history favoured the progress of Walesa as a labour leader. One was the Soviet decision of 1975 to make the most of incorrigible Poland. The other was the election of Karl Cardinal Wojtyla as the first Slavic Pope of Rome in 1978. As Pope John Paul II, Wojtyla returned to his native Poland for a historic visit in 1979.

When labour unrest erupted into massive strikes in Poland in July 1980, Walesa was an apparently obscure unemployed electrician and regarded by the authorities as a "troublemaker". Only three months later, he became one of the most powerful men in the country and had drawn 17,300,000 workers, into his union, now famous as the "Solidarity" (Solidarnosh). He received the prize for his campaign against the political tyranny by a totalitarian regime on the ill-paid and ill-fed labourers of Poland.

Economic Sciences

For having incorporated new analytical methods into economic theory and for his rigorous reformulation of the theory of general equilibrium.

DEBREU, GERARD
USA

Debreu, Gerard, b.—July 4, 1921, Calais, France. He received his D.Sc. from the University of Paris. He came to the USA as a post-doctoral scholar, enriching the environment at the Cowles Foundation for Economic Research in the University of Chicago from 1950 to 1955. During 1955-61, he worked as associate professor of economics at Yale University. He joined the University of California as professor of economics in 1962. He has been professor of mathematics there since 1975. He has been the recipient of many awards and honorary doctorates from a number of academies and universities. He has been a member and fellow of various associations and academies. Fame came to him with the publication of his classic, *The Theory of Value: An Axiomatic Analysis of Economic Equilibrium* (1959).

His works showed that a freely competitive economy can, in theory, reach a state in which supply balances demand in every market and there are neither shortages nor surpluses of any product. Such a condition is called "General Equilibrium".

1984

PHYSICS

Rubbia, Carlo / Van Der Meer, Simon

CHEMISTRY

Merrifield, R. Bruce

PHYSIOLOGY OR MEDICINE

Jerne, Neils K. / Köhler, Georges J.F.
Milstein, César

LITERATURE

Seifert, Jaroslav

PEACE

Tutu, Desmond Mpilo

ECONOMIC SCIENCES

Stone, Sir Richard

1984

Physics

For their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction.

Rubbia, Carlo, b.—1934, Gorizia, Italy. Rubbia is a physicist working at CERN (*Centre Europeen de Researches Neuclear*), near Geneva. He is engaged in nuclear research and also teaches physics at the Harvard University, USA. He relentlessly pursued researches on three critical sub-atomic particles for almost twenty years.

RUBBIA, CARLO
Italy

Rubbia's finding of the subatomic particle represented a great leap forward in proving of the so-called unified field theory, which would link the four forces of nature in a single set of equations. Two of these forces are familiar in electromagnetism, which lights bulbs and makes clothes cling, and gravity which holds humans to the ground and determines the earth's orbit around the sun. The remaining two are more exotic, the so-called strong force, which binds together the particles in a nucleus, and the weak force, which controls radioactive decay.

At CERN, Rubbia devised a method of creating supercollisions among subatomic particles that would, he predicted, produce the carriers of the weak force.

At first nobody believed his proposal particularly since it would require the conversion of the synchroton into a particle collider at a cost of US $ 55 million!

Rubbia's notions, however, had one staunch supporter, Simon van der Meer a senior engineer of CERN. Van der Meer designed a device critical to the taming of the colliding beams in Rubbia's experiment.

◆

For their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction.

Van Der Meer, Simon, b.—1925, The Netherlands. He formerly worked for Philips Electronics. He is a nuclear physicist, now working in the Centre Europeen de Researches Neuclear (CERN). He

VAN DER MEER, SIMON
Switzerland

along with Rubbia developed sub-atomic particles which were so far evading the nuclear physicists. He has a calm self-effacing personality in contrast to his Italian colleague Carlo Rubbia.

Note: The 1984 prize was awarded jointly to Rubbia and Meer.

Chemistry

For his development of methodology for chemical synthesis on a solid matrix.

Merrifield, R. Bruce, b.—1921. He started his relentless research work to create proteins in the laboratory 25 years ago. He gained fame by automating protein synthesis. Proteins are naturally produced by living cells. These are long chains of chemically linked amino acids, which group into units called peptides. Before Merrifield developed his method for protein synthesis other biologists laboured through various painstaking purification procedures which took months or years to be completed.

MERRIFIELD, ROBERT BRUCE
USA

Merrifield simplified the process by placing a microscopic bead of polystyrene inside a container and added amino acids in drops which linked up in proper order around the bead. He washed the growing chain in a purifying solution after adding each chemical, thus avoiding the possible need for further purification.

His primitive prototype of the synthesises has been improved and computer controlled. The device can now synthesize complex peptides like RNA.

Merrifield is a quiet and soft-spoken Texan, who graduated from the UCLA. He has a large family of six children and was the leader of a Boy Scout troop.

Physiology or Medicine

For theories concerning the specificity in development and control of the immune system and the discovery of the principle for production of monoclonal antibodies.

Jerne, Niels K., b.—1912, London. He obtained his first medical degree at the age of forty and entered into the field of immunological research. He is one of the greatest theoreticians in immunology today. His major theory explains how the immune system develops and matures and how its component cells are regulated. He says, "the immune system now seems more complex than when I started out. I am less optimistic that we will be ever able to understand it fully." He is the founder director of the Basel Institute of Immunology.

JERNE, NIELS K.
Denmark

◆

For theories concerning the specificity in development and control of the immune system and the discovery of the principle for production of monoclonal antibodies.

Köhler, Georges J.F., b.—1946. A West German immunologist who worked with César Milstein in Cambridge. They together developed their revolutionary laboratory technique for the production of unlimited quantities of pure, monoclonal antibodies. Along with potent drugs these antibodies could possibly provide cure for some forms of cancer in the near future. At present, he is working with Niels K. Jerne at the Basel Institute of Immunology.

KÖHLER, GEORGES J.F.
Federal Republic of Germany

◆

For theories concerning the specificity in development and control of the immune system and the discovery of the principle for production of monoclonal antibodies.

Milstein, César, b.—October 8, 1927, in Bahia Blanca, Argentina. He was once the head of the reputed Carlos Malbran National Institute of Microbiology in Buenos Aires. He had to leave his country in 1962 due to bureaucratic persecution by the military rulers. A similar incident also happened to Bernardo Alberto Houssay, the Argentine Nobel Laureate for Physiology/Medicine, who was dismissed by President Juan Peron. Houssay took a bold stand against official tyranny of Peron and refused lucrative offers from USA and started to live by doing private clinical practice!

MILSTEIN, CÉSAR
Argentina/Great Britain

But Milstein had to leave Argentina in 1962 and pursued his researches in Cambridge University. He along with Niels K. Jerne, a British born Danish scientist now based in Basel, developed the critical theories which underline the modern concept of immunology. He, Jerne and Köhler shared the Nobel Prize for Physiology/Medicine in 1984.

Note: The 1984 prize was awarded jointly to Jerne, Köhler and Milstein.

Literature

For his poetry which endowed with freshness, sensuality and rich inventiveness provides a liberating image of the indomitable spirit and versatility of man.

Seifert, Jaroslav, b.—September 23, 1901, Prague. He worked as a journalist for various dailies and periodicals. He published his first book *A City in Tears* in 1920. He was an idealistic communist from his youth, but his two trips to the Soviet Union in 1920 totally disillusioned him. He challenged the dictatorship of Stalin and was expelled from Czechoslovakia in 1929.

He came to Paris and was influenced by the *avant-garde* French poets like Guillaume A. Pollinaire and Andre Breton and was deeply impressed by the Parisian scene. He made his *avant-garde* poetic reputation during the twenties and thirties, but he principally earned his living as a journalist.

He wrote patriotic poems during the German occupation of his country and became very popular. When the communists came to power in 1948, he continued with his outspoken journalism and poetry. Some of his writings were very critical of the regime. During the political crisis of 1968 he helped to organize a major protest declaration against the communists known as *Charter 77*. He said, "if a writer is silent he is lying". During the period, subsequent to 1968, his poems were circulated privately. They became popular and were naturally disliked by the ruling power.

SEIFERT, JAROSLAV
Czechoslovakia

His major works are: *Ruce Venusing* (Venus Hands, 1936), *Maminka* (Mother, 1954), *Concert at the Island* (1968), *Mozart in Prague* (1970), *Umbrella from Piccadilly* (1978) and *All Beauty of the World* (1978).

When he received the news of the award in the hospital where he was lying ill, he expressed by saying:

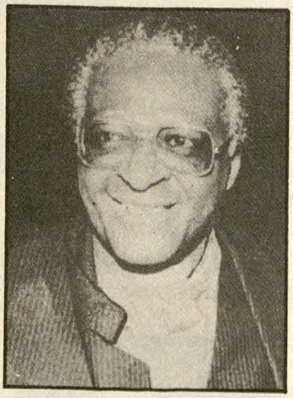
Death will soon kick open the door and enter
With startled terror, at that minute
I'll catch my breath
And forget to breathe again.

He also wrote:

To all those million verses in the world
I've just added a few
They probably were no wiser than
A cricket's chirrup,
I know. Forgive me
I am coming to the end.

Peace

Tutu, Desmond Mpilo, b.—1931, Clerks dorp, Western Transvaal, South Africa. He was born in a poor family and was forced to drop his dream of becoming a doctor when his father, a teacher, ran short of funds. He sold peanuts in suburban railway stations to finance his study. He became a school teacher but left to enter the church in 1957, after the South African Government took over the black mission schools. In 1960, he was ordained as an Anglican Deacon. After three years of study in London he returned to South Africa where he rose quickly through the church hierarchy. In 1975 he became the first black Anglican Dean of Johannesburg. He taught theology in Lesotho, an independent black African nation surrounded by South Africa. He left the post of subarban deanery of Johannesburg to live with poor black masses in Soweto. After the Nobel award he flew back to South Africa from USA and announced that he would donate his entire prize money of 195,000 US $ to a scholarship fund for black African youths. He is totally non-violent. In his famous book *Hope and Suffering* he said, "the most awful thing that they can do is to kill me, and death is not the worst thing that could happen to a Christian."



TUTU, DESMOND MPILO
South Africa

He says that the Bible is the most revolutionary book because it teaches that all people are created in the image of God. He also said that it is better to be a Christian in South Africa than anywhere else because the normal issues are so clear.

Tutu's non-violent methods and his eminence as a church leader have made it quite difficult for the South African Government to silence him.

The Government seized his passport twice, since he is allowed to travel with a document listing his nationality as "undeterminable at present"! He is the second black African after Albert Luthuli (1960) to obtain the peace prize.

Economic Sciences

For having made fundamental contributions to the development of systems of national accounts and hence greatly improved the basis for empirical economic analysis.

STONE, Sir RICHARD
Great Britain

Stone, Sir Richard, b.—1913. He is a professor emeritus at the Cambridge Institute. He worked out his ideas during World War II and later developed a national accounting system which still continues to provide a framework for countries around the world. He and Meade (Economics Laureate, 1977) prepared a war time study that organized plenty of data into a profile in British economy. After the war he headed a United Nations project that developed a standard accounting model for other countries.

He is a soft-spoken man, an avid reader and collector of books.

1985

PHYSICS

Von Klitzing, Klaus

CHEMISTRY

Karle, Jerome / Hauptman, Herbert

PHYSIOLOGY OR MEDICINE

Brown, Michael / Goldstein, Joseph

LITERATURE

Simon, Claude

PEACE

The International Physicians for the Prevention of Nuclear War

ECONOMIC SCIENCES

Modigliani, Franco

1985

Physics

For making a breakthrough in the design of semiconductors.

Von Klitzing, Klaus, b.—1943, Poland. He is the Director of the Max Planck Institute for Solid State Research in Stuttgart, West Germany. He received the prize for making a breakthrough in the design of semiconductors. He based his research work on a discovery by the American physicist Edwin Hall made in 1879. Hall observed that electricity travelling through a metallic strip is diverted to one side of the strip when a magnetic field is applied perpendicularly to the flow of the current. Klitzing expected to find that the Hall voltage in semiconductors is affected by the material from which they are made of, but he found otherwise. He also found that with the increase of magnetic force the Hall voltage did not ascend gradually, but it jumped suddenly at regular intervals. His findings provide a practical demonstration of the phenomenon, accurate within 0.0000001 of a predicted interval. Klitzing's experiment was a proof of quantization of Hall's theory.

VON KLITZING, KLAUS
Poland and Federal Republic of Germany

Chemistry

For their development of the mathematical method to determine the three-dimensional structure of molecules.

The prize was shared by two US scientists **Jerome Karle** of the US Naval Research Laboratories located at Washington and **Herbert Hauptman**, the Research Director of the Medical Foundation of the Buffalo Research Laboratories. The latter is a mathematician. Both of them first met at the City College of New York from which they graduated in 1937 along with Arthur Kornberg, the Nobel Laureate in Physiology/Medicine for 1959. They developed a mathematical method to determine the three-dimensional structure of molecules. Their method is known as the "direct method." They have analysed more than 45000 molecules with this method including basic substances like hormones and vitamins. The method has now been used to design new antibiotics and vaccines. The method is an advance in the field of X-ray crystallography, which has been employ-

KARLE, JEROME
USA

ed since 1912 for examination of the architecture of crystallized substances. An X-ray beam is aimed at a crystal, and as it travels through the crystal atoms, diffract the rays producing fuzzy spots of varying intensity on a photographic film. The diffraction pattern looks like a string of beads. Although each type of crystal produces a distinctive design, the patterns are very intricate and are rather very difficult to interpret. Karle and Hauptman evolved a complex statistical formula that takes the position and the brightness of the individual spots and reconstructs them into tridimensional picture of the crystal. For quite a long time other scientists did not pay any attention to the findings of the two, they were rather ignored for almost a decade. With the advent of high-speed computers, the effectivity of the method became clear and Karle and Hauptman at last got recognition of the scientific community of the world.

HAUPTMAN, HERBERT
USA

Note: The prize was jointly awarded to Karle and Hauptman.

Physiology or Medicine

The prize was jointly awarded to two US scientists, **Michael Brown** of the University of Texas Health Science Centre of Dallas and his colleague **Joseph Goldstein**. Dr. Brown is aged 44 years and hails from the New York City and Dr. Goldstein aged 45 years was born in Sumter, South Carolina. For the past twelve years they have carried out research work on the low-density lipoprotein (LDL) receptor, a molecule which ferries cholesterol-rich particles from the blood stream into the cell. Their explanations were precisely organized, and their slides went beyond standard diagrams.

BROWN, MICHAEL
USA

GOLDSTEIN, JOSEPH
USA

The discovery of the LDL receptor has revolutionized the knowledge of cholesterol metabolism and certain cardiovascular diseases. The mechanism through which diet and exercise can help prevent a heart attack is now better understood. By comparing the skin cells from the victims of familial hypercholesterolaemia and normal subjects they traced the problem to an absence or deficiency of LDL receptors in the former. The LDL receptors are proteins which are found in the outer membranes of most cells, particularly those of liver. They decided the complex reaction which takes place between the receptor and the particle of LDL. David Baltimore (Nobel Laureate, 1975) said that their studies are very important for understanding how cells communicate with their environment.

Note: The prize was jointly awarded to Brown and Goldstein.

Literature

For his novels combined the poet's and the painter's creativeness with a deepened awareness of time in the depiction of the human condition.

Simon, Claude, b.—October 10, 1913, Tannanarive, Madagascar. He is an exponent of the French *nouveau roman*, a form of fiction that rigorously questioned traditional narrative devices. Simon proved himself just as good and as exhausting as the form of novel writing he developed.

SIMON, CLAUDE
France

He was born in a family of vine growers in the Pyrenees mountains. He was educated in Paris and tried to become a painter. He served in the Spanish Civil War and later in the French cavalry. He was captured by the Germans in 1940 but escaped and joined the French resistance movement. His noted works include *The Wind* (1959), *Le Tricheur* (1945), *La Corde Raide* (1947), *Gulliver* (1952), *Le Sacre du printemps* (1954), *L'Herbe* (1958), *Orion avengle* (1970), *Les Corps conducteurs* (1971), *Tryptygue* (1973), *Les Georgigues* (1981), *The Flanders Road* (1961), and *The Palace* (1963).

Peace

THE INTERNATIONAL PHYSICIANS
FOR THE PREVENTION OF NUCLEAR WAR

The prize went to an organization, the International Physicians for the Prevention of Nuclear War (IPPNW). It was founded only five years ago by two cardiologists—Dr. Bernard Lown, a professor at the Harvard School of Public Health, and Dr. Yevgeny Chazov, Director General of the Soviet National Cardiological Research Centre. It was dedicated to publicizing the dangers of nuclear war. Based in Boston, it has a large membership of 135,000 physicians from over 41 countries.

Economic Sciences

For his 'Life Cycle' savings theory, which is now accepted by all economic experts as a key to the understanding of thrift.

Modigliani, Franco, b.—1918, Rome, Italy. He is a naturalized American who became a US citizen in 1946. He received a doctorate in law from

MODIGLIANI, FRANCO
Italy/USA

the University of Rome in 1939 and a doctorate in social sciences from the New School of Social Research in New York in 1944. He began teaching at the Massachusetts Institute of Technology in 1962 where he became a Professor in 1970. He is a member of the US National Academy of Sciences and has published notable works on economic sciences. He is the second faculty member of the MIT to receive the prize after Paul Samuelson (1970).

Dr. Modigliani's "Life Cycle" savings theory, developed in the fifties along with Richard Brumberg, is now accepted by all economic experts as a key to the understanding of thrift.

1986

PHYSICS

Binnig, Gerd / Rohrer, Heinrich
Ruska, Ernst

CHEMISTRY

Herschbach, Dudley / Lee, Yuan
Polanyi, John Charles

PHYSIOLOGY OR MEDICINE

Cohen, Stanley / Levi-Montalcini, Rita

LITERATURE

Soyinka, Wole

PEACE

Wiesel, Elie

ECONOMIC SCIENCES

Buchanan, James McGill

1986

Physics

For their invention of scanning tunneling microscope.

Binnig, Gerd, 39, is a German physicist. He and his Swiss research colleague Rohrer have between 1979 and 1981 designed a new and a completely different kind of electron microscope. The microscope is known as "scanning tunneling microscope", it is based on a completely new concept. It is far more accurate than the convèntional electron microscopes which were developed following the invention of the first prototype by Ruska in 1931. Binnig is now working at the IBM Physics Group of the University of Munich in West Germany.

BINNIG, GERD
Federal Republic of Germany

◇

For their invention of scanning tunneling microscope.

Rohrer, Heinrich, b.—1933, Buchs, St. Gallen, Switzerland. A Swiss physicist he holds a doctorate from the Swiss Institute of Technology in ultra-conductivity. He spent two years at the Rutgers University, New Jersey, USA (1963-65). Later he started working for IBM in Zuerich as director of the Department of Physics at its research laboratory. In 1984, he became Associate Professor at the faculty of sciences in Luminy, France, where he was engaged in the installation of a group of "tunnel microscopes". He and his West German associate Gerd Binnig invented the "tunnel microscope", which is a new concept in the field of electron microscopy. They shared the prize along with Ernst Ruska, the inventor of the first electron microscope (1937). Rohrer is now working at the Zuerich Research Centre of the IBM.

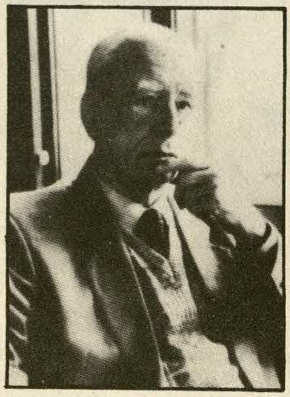
ROHRER, HEINRICH
Switzerland

◇

For his invention of the first electron microscope.

Ruska, Ernst, 80, is a retired German physicist. In 1920, it was he who first thought of using the subatomic particle electron to visualize objects too small to be seen with conventional light microscopes.

Dawn of the 20th century saw the discovery of subatomic particles. Within three decades of these discoveries, Ernst Ruska had ventured to build an electron microscope. Although ordinary microscopes provide sharp images of most bacteria and minute object, they cannot distinguish anything smaller than eight-millionths of an inch since the wavelength of visible light which is $1/10^5$th of an inch is too long. Ruska found that magnetic coils could focus electrons which have wavelengths 10^5 times shorter. Using magnets in the place of lenses and electrons instead of light, Ruska built his first electron microscope in 1931.



RUSKA, ERNST
Federal Republic of Germany

Ruska, now 80, has retired from the Fritz Haber Institute of the Max Planck Society in West Berlin. Informed of being awarded the prize for his outstanding invention while undergoing treatment for rheumatism at a health Spa, he commented, "I am very happy indeed. I believed I was forgotten."

Note: The 1986 prize was awarded jointly to Binnig, Rohrer and Ruska.

Chemistry

For their work on a new field of research in chemistry called "reaction dynamics".

Herschbach, Dudley, 54, is an American chemist. He has been working as Professor of Chemistry at the Harvard University since 1963. He obtained his doctorate from Harvard in 1958. He shared the prize with Yuan Lee and John Polanyi for their works on a new field of research in chemistry called "reaction dynamics" and provided detailed understanding of how chemical reactions take place. Herschbach and Lee were cited for their work in studying chemical reactions by forming individual molecules into beams in a vacuum and causing them to collide, providing new insight into the interactions between molecules.

HERSCHBACH, DUDLEY
USA

◇

For their work on a new field of research in chemistry called "reaction dynamics".

Lee, Yuan, 49, was born in Taiwan, Republic of China. He is the head of the Department of Chemistry at the Berkeley University in California. He along with Herschbach and Polanyi

LEE, YUAN
Republic of China

received the prize for their works on a new field of research in chemistry called "reaction dynamics". He and Herschbach were cited for their work in studying chemical reactions by forming individual molecules into beams in a vacuum and causing them to collide, providing new insight into the interactions between molecules. ◆

For their work on a new field of research in chemistry called "reaction dynamics".

Polanyi, John Charles, b.—January 23, 1929, Berlin. He had his initial science education at the Manchester University. He obtained Ph.D. from there in 1952, D.Sc. in 1964 and a honorary doctorate in science from the Waterloo University in 1970. He has been Professor of Chemistry, University of Toronto, Canada, since 1974. He obtained innumerable scholarships, fellowships and other awards. He has been the scientific advisor to the Max Planck Institute for Quantum Optics, Garching, West Germany, since 1982. His publications total over 150; he is the co-editor of *The Dangers of Nuclear War* (1979).

POLANYI, JOHN CHARLES
Canada

He shared the prize with Herschbach of Harvard and Yuan Lee of Berkeley for evolving a new field of chemical research called "reaction dynamics". He developed the method of "chemiluminescence" in which the extremely weak infrared emissions from a molecule is measured and analysed. The reaction products from a gaseous hydrogen atom and a chlorine molecule emit infrared light. Spectral analysis shows that most of the energy of this heat-releasing reaction is initially lodged in vibration of the hydrogen chloride product. The researches on *chemiluminescence* led to the discovery of dozens of chemical lasers, including two sufficiently powerful to be considered for initiation of nuclear fusion.

Note: The 1986 prize was jointly awarded to Herschbach, Lee and Polanyi.

Physiology or Medicine

For their finding out of the hitherto unknown growth factors controlling cellular growth.

Cohen, Stanley, 63, is a cellular biologist now engaged in research work at the Vanderbilt University, Nashville. He along with Levi-Montalcini found out the hitherto unknown growth factors controlling cellular growth. He extracted the first pure samples of the protein now known as nerve growth factor. He also discovered "Epidermal Growth Factor (EGF)", which governs cell development of the skin. He also located a protein on the surface of cells which acts as a receptor for EGF. The collaborative researches on growth factors by Cohen and Levi-Montalcini have opened up new vistas in the intricacies of congenital defects and oncology. ◆

COHEN, STANLEY
USA

For their finding out of the hitherto unknown growth factors controlling cellular growth.

Levi-Montalcini, Rita, b.—1909, Turin, Italy. She obtained a degree in medicine and surgery from the Turin University in 1936. She came to the USA in 1951 to work at the Washington University, St. Louis, under Viktor Hamburger, an American pioneer in the study of nerve growth. In 1953 she met Stanley Cohen at the Washington University where they found the growth factors, proteins which guide the development of immature cells. She observed in 1952 that single nerve cells taken from chick embryos and cultured with tissue from mouse tumours, sprouted nerve fibres which reached out like sunrays. So it was concluded that the tumour cells contained growth factors. She also suggests that the signal of tissue growth might come from a growth-stimulating chemical in the cells targeted by the nerves.

LEVI-MONTALCINI, RITA
Italy/USA

She shared the prize with Stanley Cohen, her colleague at the Washington University. She holds dual citizenship, Italian and American, and is at present engaged in further researches on cellular biology at the Cellular Biology Laboratories of the National Council of Scientific Research in Rome.

Note: The 1986 prize was jointly awarded to Cohen and Levi-Montalcini.

Literature

Because he in a wide cultural perspective with poetic overtones fashions the drama of existence.

Soyinka, Wole, b.—July 13, 1934, Abeokuta, Nigeria. A poet, playwright, novelist and a lecturer, he is the first black African to win the prize for literature. He was educated at the universities of Ibadan and Leeds. He worked at the Royal Court Theatre, London, and as a research fellow in drama at the University of Ibadan.

SOYINKA, WOLE
Nigeria

He has been teaching in various colleges and universities in Nigeria and England and is a fellow of the Churchill College, Cambridge. He started writing plays in 1959 when *The Lion and the Jewel* came out, which was followed by *The Swamp Dwellers* (1959). The other plays to follow were *A Dance of the Forests* (1960), *The Trials of Brother Jero* (1961), *The Strong Breed* (1962) and *The Road* (1964). His first novel, *The Interpreters*, appeared in 1964. Since then, he has written another novel *The Forest of a Thousand Demons* (1973) and his prison memories *The Man Dies* (1972).

He was a political prisoner from 1967 to 1969 and was awarded the Prisoner of Conscience award by Amnesty International in 1969. His lone collection of poems, *A Shuttle in the Crypt*, came out in 1972. Among his plays, *Kongi's Harvest* (1965) is considered his masterpiece.

He was awarded an honorary D. Litt. degree by Leeds University in 1973 and by Yale University in 1981.

Peace

One of the most important spiritual leaders and guides in an age when violence, repression and *racism continue to characterise the world, Wiesel is a messenger to mankind: his message is one of peace, atonement and human dignity.*

Wiesel, Elie. Wiesel was born in a Jewish family in Sighet a remote town in the Carpathian Mountains in Rumania and is 59 years old. He spent his childhood in Sighet learning the *Torah* and humanist literature. The Nazi invasion of 1944 saw the deportation of the Jewish population and Wiesel lost his mother and youngest sister in Auschwitz death camp and later his father at Buchenwald. On his liberation from the concentration camp in 1945, after ten years of imprisonment, he vowed that he would not speak of the horrors for at least ten years. His teenage memories of the Nazi atrocities in the death camps are described in his first novel *Night* (1958).

WIESEL, ELIE
Romania/USA

After the war, Wiesel went to France where he studied Philosophy at the Sorbonne and later worked as a journalist. He was greatly influenced by Albert Camus and Francois Mauriac. He broke his self-imposed silence after ten years and gave vent to his pent up painful memories in his novels, essays, speeches and lectures. He coined the word 'holocaust' but believes that the word has since been 'trivialised and vulgarised'.

He moved to the United States in 1957. He was lecturer and professor at the City College, New York, before moving to Boston University. In April 1985, he was awarded the Congressional Gold Medal of Achievement. At the ceremony for this award he implored President Reagan to call off his visit to the military cemetry of Hitler's SS in Bitsburg, West Germany, which incidentally was not heeded to.

Wiesel has written 30 books and he is concerned about a whole range of issues and has worked to help Cambodian refugees, the Misikito Indians in Nicaragua and the starving children of Africa. Of late his biggest concern is the nuclear arms race. He suggested that Reagan and Gorbachev should meet in Hiroshima. 'That', he said, 'would be a poetic way of dealing with politics'. Wiesel has been contender for both the Nobel Peace and Literature prizes for several years. On being awarded the Peace Prize he said, 'I dont't think that prizes validate work. They give stature, texture, the possibility to reach more people. There's a mystique about the Nobel. It gives you a better loudspeaker'.

Wiesel is married, has a 15-year old son and lives in Manhattan.

Economic Sciences

For his 'Public Choice Theory' wherein he reasons that politicians and public servants act primarily to promote their own self interest, not to serve some public good, behaving much like consumers in a market place.

Buchanan, James McGill, 68, born in Tennessee is the fourteenth American to be honoured by the Nobel prize for Economics. He was awarded the prize for his 'Public Choice Theory' wherein he reasons that politicians and public servants act primarily to promote their own self interest, not

BUCHANAN, JAMES McGILL
USA

to serve some public good, behaving much like consumers in a market place. Governments reflect the actions and choices of politicians just as markets operate on the decisions of consumers who buy and sell, the politician being primarily motivated by a desire to get re-elected. He says their natural proclivity is to spend more and not tax, resulting in a regime of permanent budget deficits. The remedy he suggests is to change the rule of the game and impose a constraint on politicians when it comes to spending, and supports a constitutional amendment to require Congress to balance the budget.

His basic theory of political economy, applying the discipline of economics to the study of political decision making, has many detractors who claim it is 'unsophisticated'. Buchanan himself admits his ideas are 'not standard' but says many of his theories are 'simple applications of common sense that the academics all forget about!'

Buchanan has several admirers among members of the Reagan Administration. Among them are James Miller III, Director of the Office of Management and Budget, who was also his doctoral student in the 1960s and a former George Mason Professor who is now Chairman of the Federal Reserve Board.

Buchanan is professor at George Mason University, Fairfax. When not teaching he runs a 400 acre farm near Blackburg. His comment on being chosen for the Nobel prize was, 'I had no premonition this would happen. I was shocked.'

1987

PHYSICS

Müller, Karl Alex

Bednorz, Johannes Georg

CHEMISTRY

Cram, Donald J. / Lehn, Jean-Marie

Pedersen, Charles J.

PHYSIOLOGY OR MEDICINE

Tonegawa, Susumu

LITERATURE

Brodsky, Joseph

PEACE

Sánchez, Oscar Arias

ECONOMIC SCIENCES

Solow, Robert

1987

Physics

For their discovery of high temperature superconductivity.

Müller, Karl Alex, 60 is a physicist who received his Ph.D. from the Swiss Federal Institute of Technology in 1958. He has been doing research in solid state physics at the IBM Zürich laboratory since 1963. He has been an IBM fellow since 1982.

MULLER, KARL ALEX
Switzerland

Superconductivity is a phenomenon in which a conducting material loses its normal resistance to the passage of electricity; since virtually no energy is lost, any electric device becomes far more efficient when built with superconductors.

In 1984 two French chemists Claude Michel and Bernard Ravean created a new compound of copper, oxygen, lanthanum and barium. Coming across this work **Bednorz** (37) and Müller set out in their search of a substance that would carry current with no loss of electricity at a warmer temperature. The phenomenon of superconductivity was discovered in 1911 in frozen mercury, cooled almost to absolute zero. In the years that followed, other pure metals and then alloys revealed superconductivity at slightly warmer temperatures. In the 1970s progress in this field had come to a standstill although a few peculiar oxide superconductors had been discovered.

BEDNORZ, JOHANNES GEORG
Federal Republic of Germany

Müller and Bednorz started testing materials, mixing and baking them and in attaching electrodes to their samples to pass small currents through them. Their tools were a standard cooling flask, some volt meters and a personal computer. Initial results were so frustrating and their quest so quixotic that they kept it secret even from most of their superiors at IBM.

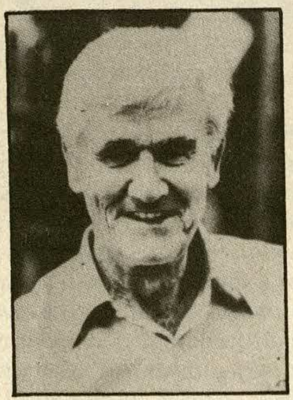
Müller got his inspiration while walking in a monastery garden during a 1983 conference in Erice, Sicily. Although most existing superconductors were metals, theorists have suggested that ceramic insulators at room temperature might also work because of their molecular structure. Stirred by a lecture on the subject, he thought of specific kinds of ceramics that could do the job. At last, in a small room at the IBM Laboratory in Zürich, Müller and Bednorz discovered in a dark fragment of ceramic what most specialists had given up as an impossibility: a complete loss of electrical resistance at temperatures far higher than ever before. They were chosen for the prize for their great discovery.

Note: The 1987 prize was jointly awarded to Müller and Bednorz.

Chemistry

For their creation of artificial molecules that can mimic the behaviour of hormones and other organic substances.

Cram, Donald J., was born in 1919. He received his Ph.D. from Harvard University in 1947. He became professor of chemistry at the University of California at Los Angeles (UCLA) and has been there ever since.



CRAM, DONALD J.
USA

The art of organic synthesis has been developing quite rapidly in the recent years. Cram and Lehn, working independently, have produced synthetic molecules that to some extent mimic the action of enzymes. They pioneered a field that exploits the idea that three-dimensional shapes of molecules are vital to their chemical and biological functions. Although the work is primarily in pure science, it has immense possibilities of application. One possibility is the creation of totally artificial enzymes which might prove extremely valuable in medical and industrial applications.

Cram is a researcher whose influence is felt throughout the world. A great majority of chemists researching on molecular studies in countries like the Netherlands or Japan have worked under him. The field, one of the most active and rapidly expanding, is called 'host-guest chemistry'—a term coined by Cram.

◇

For their creation of artificial molecules that can mimic the behaviour of hormones and other organic substances.

Lehn, Jean-Marie, 48, was born in Rosheim, France. He received his doctorate in chemistry from the University of Strasbourg in 1963. He has been a professor of chemistry at the Louis Pasteur University in Strasbourg since 1970, and a professor of chemistry at the College de France in Paris since 1979.

LEHN, JEAN-MARIE
France

Lehn's prize-winning work was on taking crown ethers and making them into artificial enzymes, thereby producing a synthetic molecule which acts as a host for acetylcholine, one of the most important signalling substances of the human brain and nervous system.

Explaining this work, Lehn said, "The basis of our work is the way molecules are able to recognise each other". In nature molecules that work together have complementary shapes, like a lock and a key, and only the right key will fit to initiate a given reaction. In essence, Lehn along with Pedersen and Cram managed to create synthetic molecular keys that fit the locks. Those new molecules have been used experimentally to partially detoxify rats contaminated with lead or radioactive strontium.

Lehn is considered an *enfant terrible* in his field of research which he likes to call "supra molecular chemistry"

◆

For their creation of artificial molecules that can mimic the behaviour of hormones and other organic substances.

Pedersen, Charles J., was born in 1904 in Pusan, Korea, to a Norwegian father and a Japanese mother. He went to the United States in 1927 to study chemical engineering at the University of Dayton, Ohio. After graduation he went to the MIT and received his master's degree in organic chemistry.

Pedersen began work at Du Pont de Nemours Co. as research chemist and remained there until his retirement at the age of 65 in 1969. His work at the company resulted in 25 papers and 65 patents.

PEDERSEN, CHARLES J.
Korean/USA

While the other two scientists amplified and expanded the scope of the research, Pederson is credited with making the first major contribution to the studies which led to the creation of artificial molecules that can mimic vital chemical reactions of the processes of life.

Pedersen was noted particularly for the development of compounds called crown ethers that form complexes with particular ions. His scientific works, published in 1967 which describe the synthesis of the compounds "cyclic polyethers", have become classics. Compounds like the crown ethers can be used, for instance, to extract radioactive strontium or toxic substances such as cadmium or lead from mixtures or tissue samples.

Note: The 1987 prize was jointly awarded to Cram, Lehn and Pedersen.

Physiology or Medicine

For proving that cells accomplish the Herculean task of making antibodies to order by reshuffling parts of the genes that govern the production of antibodies, the cellular building blocks of the immune system.

Tonegawa, Susumu, 48, won the prize for his monumental work on immunological defences of a body against infamiliar disease agents.

A student of chemistry at Kyoto University, he first became interested in immunological studies on reading a research paper by Nobel Laureates Jacques Lucien Monod and Francois Jacob, and changed his major. After graduation, he moved to the United States on the advice of his mentor Dr. Itaru Watanabe. He obtained his doctorate in biology from the University of California in 1963. After the expiry of his visa in 1971, he was forced to leave the US and ended up at Switzerland's Basel Institute for Immunology. Here he did much of the basic research that eventually led to his discovery, and solved a mystery that baffled scientists for more than 100 years. He published the results in a series of articles in the *Proceedings of the National Academy of Sciences*.

Tonegawa studied antibodies produced by a type of white blood cell called 'B lymphocyte'. It was known that B lymphocyte could produce only its own unique antibody. But how the number of different antibodies in an individual could theoretically exceed the number of B lymphocytes remained a mystery. Tonegawa while studying cancerous cells showed that different pieces of the genes forming the antibodies could be shuffled, recombined or even lost to give rise to the DNA that is found in mature B lymphocyte and thereby to an enormously diverse array of antibodies. Although he did not originate the genetic change theory, he proved it in a most elegant and convincing manner.

TONEGAWA, SUSUMU
Japan/USA

Tonegawa's research has implications in other fields of medicine—it could help improve the effectiveness of vaccines, develop a variety of immunological therapies, and could find application in organ transplant surgery.

He is the first Japanese to be awarded the prize for physiology or medicine and the fifth Laureate from his country.

Tonegawa has been at the Massachusetts Institute of Technology (MIT) since 1981.

Literature

For an all embracing authorship, imbued with clarity of thought and poetic intensity.

Brodsky, Joseph, b.—May 24, 1940, Leningrad, Russia. Brodsky was born to Jewish parents and, in his own words, is, "part Jew, part Russian, part Christian... in short, a bad Jew" He quit school at 15 and took a series of jobs that included mill hand, morgue employee, labourer on a geological expedition, a stoker on a ship and translator. In his childhood he became aware of antisemitism and social oppressiveness and these impressions are reflected in *The End of a Beautiful Era*.

Brodsky was twice sent to mental institutions and served 18 months at hard labour. He was convicted for being "a social parasite" and denounced for writing "youth-corrupting, pornographic and anti-Soviet poetry". Among the evidence that convicted him was changing jobs 13 times in 8 years. After labouring on the state farm in the Arctic for 18 months, he was released in 1969. Released but still convinced that his mission on earth was to write rather than surrender his skills to the dictates of the state, he took to writing again.

He turned down two invitations to emigrate to Israel in 1971 and was finally ousted from Russia in 1972. He was deported from his country with nothing more than his typewriter ("which was unscrewed bolt by bolt at the airport—that was their way of saying goodbye", recalled Brodsky), a book of John Donne's poems and a bottle of vodka. Unmarried, he left behind a son, Andrei, now a teenager. Brodsky has not seen his son in 15 years.

BRODSKY, JOSEPH
Russia

In Vienna, as an "emigre", he was under the protection and guidance of W.H. Auden and, through his contacts, was appointed a poet-in-residence at the University of Michigan. He acquired US citizenship in 1977 and has since then lived there. In 1981, he was in the first batch of geniouses to receive the MacArthur Foundation Fellowships.

Brodsky has taught at the New York University, Columbia University, Massachusetts and Cambridge.

Peace

For his outstanding contribution to the possible return of stability and peace to a region long torn by strife and civil war.

Sánchez, Oscar Arias, 46. He is the President of the Latin American state of Costa Rica. By dint of his hard labour and protracted negotiations with the authorities of the various Central American states his peace plan for the region was signed two months before the investiture of the Nobel award in Guatemala City by five Central American Presidents.

SÁNCHEZ, OSCAR ARIAS
Costa Rica

In due recognition of his brilliant peace initiative he was given the prize. Arias is the fourth Latin American in the Prize's 87-year history to join the pantheon of peace laureates, the Argentinian Carlos Saavedra Lamas (1936), the Argentinian Adolfo Perez Esquivel (1980), and Mexico's Alfonso Garcia Robles (1982).

The Nobel prize carries with it a cheque for $341000 which Arias intends to use to create a foundation for his country's poor people.

Economic Sciences

For his development in the 1950s of a mathematical model illustrating that long-term growth depends on technological progress and is not driven solely by increases in capital and labour.

Solow, Robert, 63, was born in Brooklyn. He won the prize for a pioneering 1956 study demonstrating that the rate of technological progress does more to determine an industrialized country's growth than the size of its labour force or its investments in new factories or equipment. Governments around the world have paid heed to his lesson by steering money directly into technological research and development.

SOLOW, ROBERT
USA

A senior economist on the staff of the Council of Economic Advisers in the early sixties, Solow helped shaping the interventionist policies that dominated the Kennedy and Johnson years. He continues to be a leading advocate of government intervention to correct the natural imbalances of the marketplace. Though he has never hidden his disdain for "Reaganomics", he was vociferous in denouncing President Reagan's economic policies that led to the recent crash. "The best thing you can say about Reaganomics", he said, "is that it probably happened in a fit of in-attention".

Solow is a good speaker and a good writer, and has excellent command over English. His popular essays and book reviews are full of wit. He is a professor at the Massachusetts Institute of Technology. His wife, Barbara, is an economic historian at Boston University. They have two grown up sons and a daughter.

Appendix

Twice Recipients of the Nobel Prize

Different Subjects

Madame Curie Sklodowska	1903	Physics
—do—	1911	Chemistry
Linus Pauling	1954	Chemistry
—do—	1962	Peace

Same Subject

John Bardeen	1956	Physics
—do—	1972	Physics
Frederic Sanger	1958	Chemistry
—do—	1980	Chemistry

Nobel Laureates: Familial

Father, Mother, Daughter and Son-in-Law

Pierre Curie	1903	Physics
Madame Curie	1911	Chemistry

Daughter

Irene Joliot Curie	1935	Chemistry

Son-in-Law

Frederic Joliot	1935	Chemistry

Husband and Wife

Pierre Curie	1903	Physics
Madame Curie	1903	Physics
Frederic Joliot Curie	1935	Chemistry
Irene Joliot Curie	1935	Chemistry
Carl F. Cori	1947	Physiology/ Medicine
Gerty T. Cori	1947	Physiology/ Medicine
Gunnar Myrdal	1979	Economic Sciences
Alva Myrdal	1982	Peace

Father and Son

Sir William Bragg	1915	Physics
Sir Lawrence Bragg	1915	Physics
Sir Joseph John Thompson	1906	Physics
Sir George Paget Thompson	1937	Physics
Niels Bohr	1922	Physics
Aage Niels Bohr	1975	Physics
H. von Euler Chelpin	1929	Chemistry
Ulf von Euler	1970	Physiology/ Medicine
Karl Manne Siegbahn	1924	Physics
Kai Siegbahn	1981	Physics

Uncle and Nephew

Sir C.V. Raman	1931	Physics
S. Chandrasekhar	1983	Physics

Brothers

Jan Tinbergen	1969	Economic Sciences
Nikolaas Tinbergen	1973	Physiology/ Medicine

Brothers-in-Law

Charles Hard Townes	1964	Physics

Arthur Schawlow	1981	Physics

Ethnic Jewish Nobel Laureates

PHYSICS

1907	Albert Abraham Michelson	USA
1908	Gabriel Lippmann	France
1921	Albert Einstein	German/Swiss/US
1922	Niels Bohr	Danish
1925	James Franck	German
1925	Gustav Hertz	German
1943	Otto Stern	German/US
1944	Isidor Isaac Rabi	Polish/USA
1952	Felix Bloch	Swiss/US
1954	Max Born	German
1959	Emilio Segre	Italian/US
1960	Donald A. Glasser	USA
1961	Robert Hofstadter	USA
1962	Lev Davidovich Landau	USSR
1965	Richard Philips Feymman	USA
1965	Julian Schwinger	USA
1967	Hans Albrecht Bothe	German/USA
1969	Murray Gell-Mann	USA
1971	Dennis Gabor	Hungary/England
1973	Brian David Josephson	England
1975	Benjamin R. Mottleson	USA/Denmark
1975	Aage Bohr	Denmark
1976	Burton Richter	USA
1978	Piotr Leonidovitch Kapitza	USSR
1978	Arno Penzias	German/USA
1979	Sheldon Lee Glashow	USA
1979	Steven Weinberg	USA

CHEMISTRY

1905	Adolph von Bayer	German
1906	Henri Moissan	French
1910	Otto Wallach	German
1915	Richard Willstaetter	German
1918	Fritz Haber	German
1943	George Charles de Hevesy	Hungarian/Denmark/Sweden
1961	Melvin Calvin	USA
1962	Max Ferdinand Perutz	Austrian/British
1972	William Howard Stein	USA
1979	Herbert Brown	British/USA
1980	Paul Berg	USA
1980	Walter Gilbert	USA
1981	Roald Hoffmann	Polish/USA
1982	Aaron Klug	South African/British
1983	Henry Taube	Canadian/US
1986	Dudley Herschbach	USA

PHYSIOLOGY OR MEDICINE

1908	Elie Metchnikoff	Russian/French
1908	Paul Erlich	German
1914	Robert Barany	Austrian/Swedish
1922	Otto Meyerhoff	German
1930	Karl Landsteiner	Austrian/USA
1931	Otto Warburg	German
1936	Otto Loewi	German/Austrian
1944	Joseph Erlanger	USA
1944	Herbert Spencer Gasser	USA
1945	Ernst Boris Chain	German/British
1946	Hermann Joseph Muller	USA
1950	Tadeus Reichstein	Polish/Swiss
1952	Selman Abraham Waksman	Russian/USA
1953	Hans Krebs	German/British
1953	Fritz Albert Lipmann	German/USA
1958	Joshua Lederberg	USA
1959	Arthur Kornberg	USA
1964	Konrad Bloch	German/USA
1965	Francois Jacob	French
1965	Andre Lwoff	French
1967	George Wald	USA
1968	Marshall Nierenberg	USA
1969	Salvatore Luria	Italian/USA
1970	Julius Axelrod	USA
1970	Sir Bernard Katz	German British
1972	Maurice Gerald Edelman	USA
1975	David Baltimore	USA
1975	Howard Temin	USA
1976	Baruch Samuel Blumberg	USA

1977	Rosalyn Sussman Yalow	USA
1978	Daniel Nathans	USA
1980	Baruj Banacerraf	Venezuela/ USA
1982	Bengt Samuelson	Swedish
1984	Cesar Milstein	Argentina
1985	Joseph L. Goldstein	US
1986	Rita Levi-Montalcini	Italy/USA
1986	Stanley Cohen	USA

LITERATURE

1910	Paul Johan Ludwig von Heyse	German
1927	Henri Bergson	French
1958	Boris Pasternak	Russian
1966	Shmuel Yosef Agnon	Polish/Israel
1966	Nelly Sachs	German/ Swedish
1976	Saul Bellow	Canada/ USA
1978	Isaac Bashevis Singer	Polish/USA
1981	Elias Canetti	Rumania/ Austria/USA
1987	Josef Brodsky	USSR/USA

PEACE

1911	Alfred Fried	Austrian
1911	Tobias Michael Carel Asser	Dutch
1968	Rene Cassin	French
1973	Henry Alfred Kissinger	German/ USA
1978	Menachem Begin	Polish/Israel
1986	Elie Wiesel	Romania/ USA

ECONOMIC SCIENCES

1970	Paul Anthony Samuelson	USA
1971	Simon Kuznets	USA
1972	Kenneth Joseph Arrow	USA
1974	Leonid Kantorovich	USSR
1976	Milton Friedman	USA
1978	Herbert Alexander Simon	USA
1980	Lawrence Klein	USA
1985	Franco Modigliani	USA
1987	Robert Solow	USA

Nationality Break-Ups of the Nobel Laureates

PHYSICS

USA	51
British	20
German	18
French	9
USSR	7
Dutch	6
Swedish	4
Danish	3
Japanese	3
Austrian	2
Italian	2
Swiss	2
Indian	1
Irish	1
Pakistani	1

CHEMISTRY

USA	32
German	24
British	22
French	7
Swiss	5
Swedish	4
Canadian	3
Dutch	2
USSR	1
Austrian	1
Italian	1
Belgian	1
Japanese	1
Finn	1
Czechoslovakian	1
Norwegian	1
Argentinian	1
Hungarian	1
S. Africa	1

PHYSIOLOGY OR MEDICINE

USA	63
British	21

German	13
French	9
Swedish	8
Swiss	6
Danish	4
Belgian	3
Canadian	3
Austrian	3
Argentinian	2
Australian	2
Dutch	2
Italian	2
Spanish	1
Portuguese	1
Scotish	1
Japanese	1
USSR	1

LITERATURE

French	13
USA	10
British	8
Swedish	7
German	5
Italian	5
Spanish	4
Danish	3
USSR	3
Irish	2
Chilean	2
Swiss	2
Greek	2
Norwagian	2
Polish	1
Belgian	1
Indian	1
Icelander	1
Yugoslav	1
Israeli	1
Japanese	1
Mexican	1
Czechoslovakian	1
Finnish	1
Nigerian	1
Guatemalan	1

PEACE

USA	16
French	9
British	7
Swedish	5
Swiss	3
Belgian	3
Irish	3
Austrian	2
Argentinian	2
Norwegian	2
Danish	1
Italian	1
Costa Rican	1
Canadian	1
Rodesian	1
Vietnamese	1
Japanese	1
USSR	1
Israeli	1
Egyptian	1
Indian	1
Mexican	1
Polish	1
South African	1
Dutch	1

ECONOMIC SCIENCES

USA	15
British	4
Swedish	2
Dutch	1
Norwegian	1
USSR	1
Austrian	1

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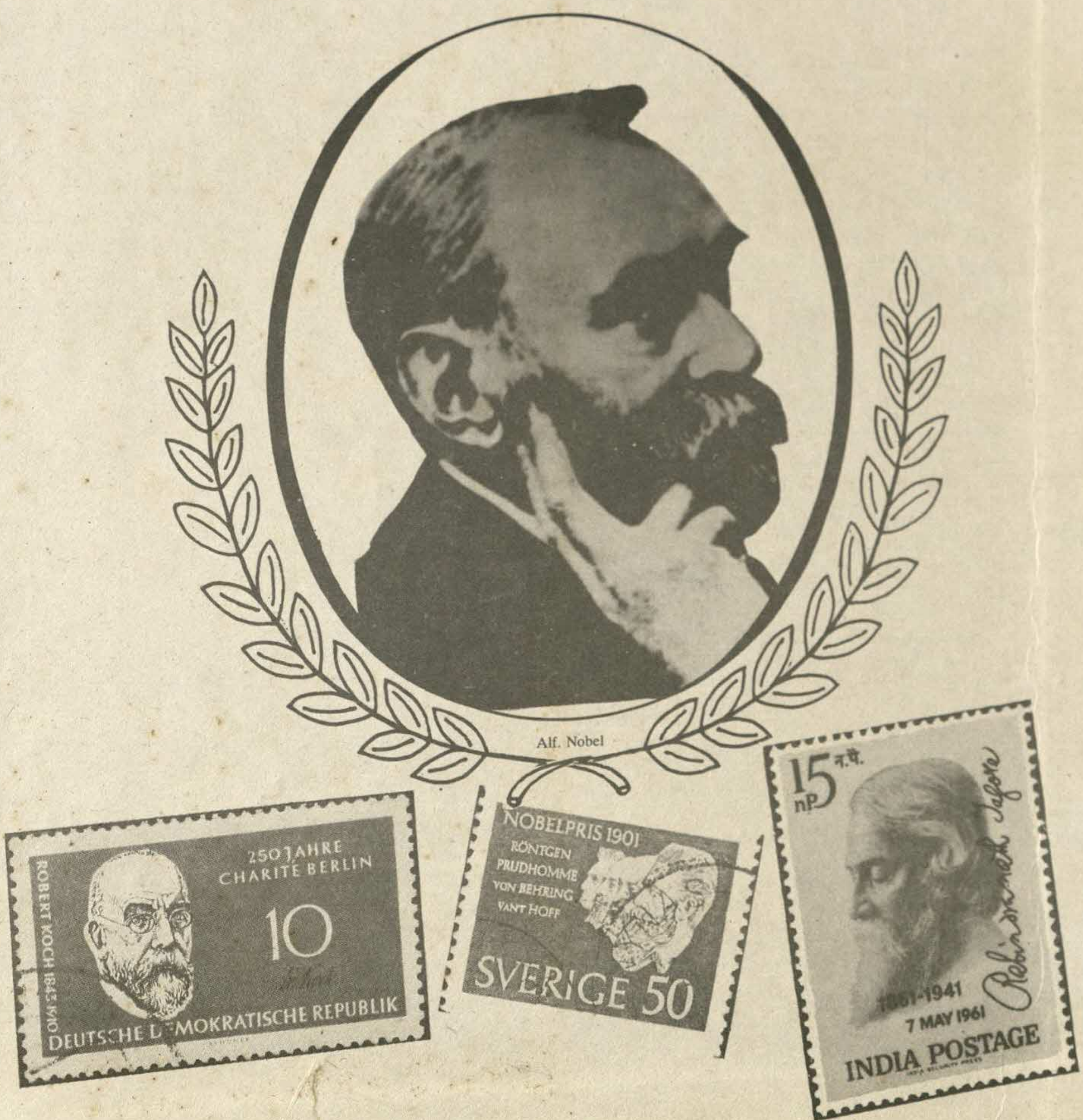
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